

# ELECTRONICS

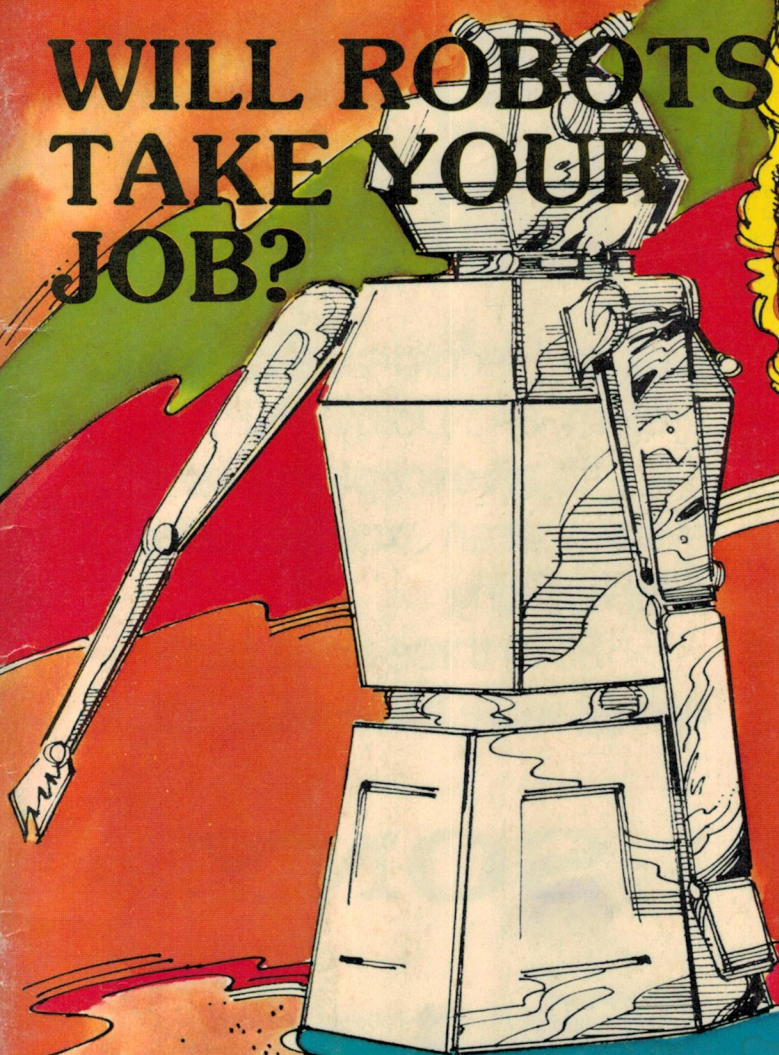
Australia

HiFi, Video & Computers

DECEMBER, 1980

AUST \$1.60\* NZ \$1.70

**WILL ROBOTS  
TAKE YOUR  
JOB?**



**NEW MOSFET  
STEREO AMPLIFIER**

**LOTTO  
NUMBER SELECTOR**

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\$350 HEADPHONES**



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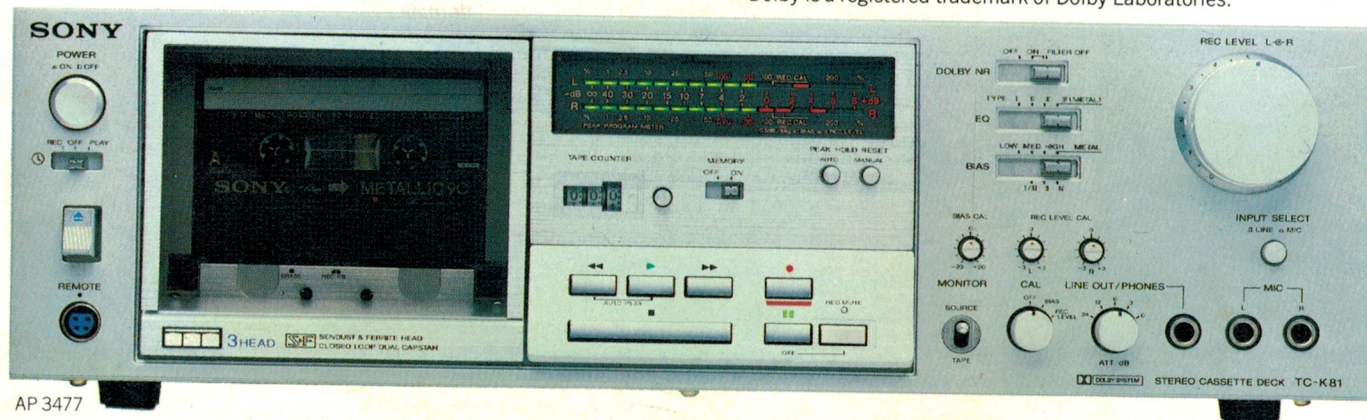
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# ELECTRONICS

## Australia

Volume 42 No. 9

December, 1980

Australia's largest selling electronics magazine



This new stereo amplifier features muting and loudness controls, loudspeaker switching, Mosfet power transistors, and a power output of 50W RMS per channel. Details p44.



Got the gambling bug? Why not build the "Selectalott", our new electronic number selector for Lot-to? You could win a million dollars. See p52.

COMING NEXT MONTH — Find out what's coming by turning to p124.

### On the cover

Modern unemployment is the inevitable consequence of modern technology — that's the conclusion of Professor John Blatt of the University of NSW. Professor Blatt's thought-provoking article "Will Robots Take Your Job?" starts on p12. (Cover design by Garry Lightfoot.)

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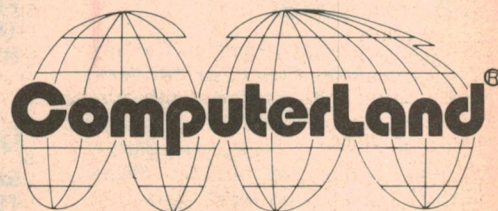
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July 1980







# Editorial Viewpoint

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## Scaling greater heights . . . or plumbing the depths of despair?

In the September issue, I raised the question of "Automation: a threat or an opportunity?" I talked about the mounting impact of technology on our traditional social structure and concluded on the following note:

"On the face of it, this kind of thinking tends to rob electronics of some of its former simplistic zeal. Behind each new and fascinating development lies the shadow of its social implications.

"But for electronics engineers to feel guilty or to back off is not an appropriate or even a practical response. If automation can open the way to a lesser workload and (hopefully) to meaningful leisure, the obligation is on the community to take advantage of the opportunity so presented.

"The dilemma is social rather than technological."

This mood of engineering introspection was carried a great deal further in the November issue of the well known UK journal "Wireless World". Under the heading "Microchips and Megadeaths", their editorial led off with an horrific quote from an eyewitness account, Hiroshima, 6 August, 1945. And I mean "horrific"!

"Engineers played their part in making these events," says the WW writer. "Thirty-five years later their role has become central" because they have made it possible for the cumbersome and vulnerable manned bomber to be replaced by electronically guided missiles such as Britain's Trident and NATO's Tomahawk.

The editorial sees politicians, generals and industrialists as monomaniacs, locked like drug addicts into a "self-perpetuating system of threat and counter threat". It quotes similar misgivings from the American publication "Science" and concludes: "Because we know what this technology can do, we should be among the leaders of dissent."

Having offered such opinion, editor Tom Ivall's dilemma is highlighted elsewhere in the same issue by a routine article on Farnborough 1980, proudly displaying two recent products of British technology — a Comet/Nimrod surveillance aircraft with look-down radar, and a Sea King helicopter fitted out with night-vision equipment for the pilot. Fascinating, but . . .

I, too, face a dilemma in seeking to round off such remarks with greetings appropriate to the Christmas season. But is it a dilemma? Perhaps at Christmas, we gain a fleeting glimpse of the goodwill that, in larger measure, could turn our technology to better ends.

**Neville Williams**

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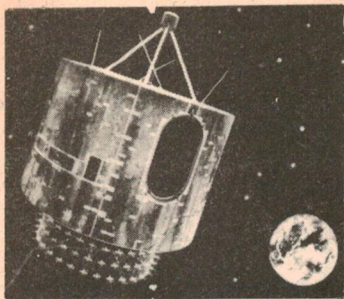
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\* Recommended and maximum price only.





# News Highlights

## Computer-controlled cars are on the way

by Geoffrey Charlish,  
Financial Times

After some five years of piecemeal announcements from many companies about the application of small computers and other electronics to the motor car, General Motors now seems to have taken the plunge in a big way with the quite unambiguous statement that "from today, virtually all GM petrol-driven cars built in the US will be fitted with a small digital computer about the size of a text book."

It claims as a result to have become the largest manufacturer of computers in the world (albeit by unit count, not by value) because some 18,000 to 20,000 of these units are being made per day at the Kokomo and Milwaukee plants of Delco Electronics Division (a GM subsidiary).

The two-board microcomputer has been christened Computer Command Control (CCC) and appears to be able to carry out most the tasks so far suggested for the car computer and several others besides.

Basic tasks are to regulate precisely the air fuel mixture entering the engine to give optimum fuel economy, improved engine performance and much better control of exhaust emission.

Variability of the GM models is easily taken care of in the way in which the computer is programmed: the same CCC is used in all cases.

An interesting result of this highly significant GM move is that many conventional engine components have had to be redesigned. The distributor on most models for example has no vacuum advance and no centrifugal advance mechanism: the necessary instructions come from the computer. Spark timing is of course also controlled.

But there are some extraordinary refinements to the basic functions in the various new GM models.

For example, the engine in one of the Cadillac models can be automatically converted from six litres V8 to 4.5 litres V6 and then to three litres V4 as and when power needs change — the result of continuous total monitoring of the situation by the computer.

Similarly, the air conditioning and the seat positioning can be controlled; in the latter case the computer remembers the desired positions for various drivers.

Built into the software is a diagnostic program; this monitors the engine control system sensors and actuators, memorises any malfunction even if temporary and alerts the driver by means of a tell-tale light on the instrument panel.

The system will then substitute nominal values for the critical sensors, allowing the car to keep going until repairs can be made.

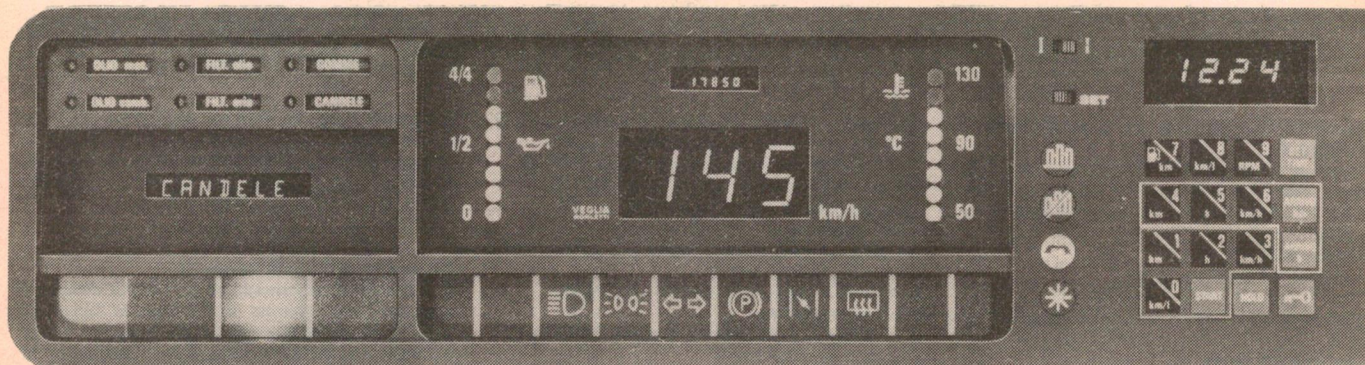
### Add-on electronic cruise control

Zemco Inc, a leading US manufacturer of automotive on-board computers, has added a microcomputer controlled cruise control to its range. While various forms of cruise control have been available in the US for over 15 years, the product is a relatively new concept for the average motorist in Australia. Cruise control has previously been available as an option only on some expensive imports, although recently General Motors- Holden has made one available on the Commodore.

Claimed advantages of cruise controls include reduced fuel consumption and greater driver comfort on long trips.

The Zemco Cruise Control is available in Australia from Antelope Engineering Pty Ltd (68 Alfred St South, Milson's Point 2061), and comes complete with a comprehensive fitting manual for straightforward installation by the handyman. Price is around \$88.00.

## Electronic dashboard panel contains a microprocessor



Developed by the Italian firm Borletti, this new electronic dashboard can monitor a myriad of engine and safety-related functions. Included are monitoring functions for oil level, brake fluid level, water level and temperature, gearbox oil pressure, brake pad wear, locking of doors, vehicle lights, and

the length of time that spark plugs, engine and gearbox oil and air filter have been in service. Also included is a trip computer (right) for calculating average speed, average and instantaneous fuel consumption, elapsed time, distance to go, etc.



# Nuclear accidents: the 10 minute myth

The accident at Three Mile Island (TMI) has focused attention on the human factors involved in the design and operation of nuclear power plants. In the US, the Electric Power Research Institute (EPRI) recently completed a series of experimental exercises with operators placed in nuclear control room simulators and came up with an unexpected result.

The exercises ranged from such minor tasks as plant startup to minor instrument failures, through to loss of coolant and

other major factors. While the results showed that operators quickly recovered from minor problems, they also showed that it took far longer for operators to regain their composure after a major accident than had previously been thought.

Currently, it is accepted in the US that a nuclear plant operator may not be depended upon for 10 minutes after a major mishap, and most plants are designed to take this into account. The EPRI study, however, showed that



operators needed 20 to 30 minutes to collect their wits after an accident — a finding which could have major implications for the design of future nuclear plants.

## GM to market electric car

A recent news item in the American magazine "Popular Science" says that General Motors plans to market an electric car during the 1984 model year. The car will be strictly a commuter type, with two-passenger capability and short-drive capability.

According to PS, there will be no major breakthroughs. Top speed will be around 80km/h, while maximum driving range will be less than 160km. Constant cruising at top speed will cut this range in half, however. The rechargeable batteries are expected to last 48,000km.

## What's new in windmill research?

A team from the Cranfield Institute of Technology's School of Mechanical Engineering in Eastern England is investigating some of the key problems of power from the wind as part of a \$1 million research program into windmills.

Windmills are now regarded in Britain as a serious alternative means of generating energy. The UK Central Electricity Generating Board is currently seeking a safe, reliable and good-looking windmill that can be installed to produce power from the mid-1980s.

Under a joint collaboration with Delft University in Holland, the Cranfield researchers aim to improve the efficiency of windmills by persuading a greater mass of air to flow through the rotors. They are to evaluate an idea of fitting small metal vanes to the rotor tips, a step which could increase airflow through the rotors by as much as 200%.

A gain of as little as 10% on a large windmill could produce a worthwhile cut in per unit energy costs.

Cranfield is also carrying out feasibility studies in eight different parts of the world to see if there is a future for windmills in these areas.

## Click go the robots BUT WHAT WILL THE SHEEP THINK?

"Robots will take over Australia's total shearing workload within five years" — that's the prediction of Mr Eric Fender, General Manager of Actrol Automation, Sydney. Actrol has just released in Australia two new industrial robots developed by the US company Unimation Inc.

The new robots are the "Puma", which has vision capability, and the "Apprentice", a portable unit which can be easily set up on site as required. Mr Fender predicts that 400-500 Pumas could be sold in Australia and New Zealand each year for the next 10 years.

The "Puma" occupies no more space in a given situation than a human worker, and has five axes of rotation corresponding to the waist, shoulder, elbow, wrist-bend and hand movements of a human. Another feature is that the arm can be separated from the controller by up to 3.3 metres with the use of a cable.

Microprocessor controlled servos position the arm of the Puma and overall control is effected by means of an LSI-11 microcomputer. The model is able to repeat positions to within 0.1mm.

A solid state camera is used for vision imaging and allows the Puma model to process visual information, thus aiding assembly operations such as the location, identification and grasping of disoriented parts.

The Apprentice robot is designed to make difficult vertical and out of position welding easy. The Apprentice can be set up on site in a confined space and, after programming, be left unattended to complete the welding job. Applications include welding of ship hulls, large steel structures, road construction equipment, agricultural machinery, etc.

In Australia, four Pumas have already been sold and the first is undergoing trials for the automatic shearing of sheep — a project that is being funded by the Australian Wool Corporation to the tune of \$250,000. The aim is to replace sheep shearers of the human variety with shearers of the robot variety.

In the technique under development, the sheep are electrically stunned before the robot goes to work — a technique said to be less traumatic for the sheep and approved by the RSPCA.

## Sigma Data sells call system to TAA

One of the early signs of convergence between computing and telecommunications in Australia is an order signed between Trans Australia Airlines and computer supplier, Sigma Data.

Sigma has sold its Infoswitch Automatic Call Distribution (ACD) system to the airline's Perth reservation centre to process incoming calls. The marketing of ACD equipment has until now been almost exclusively the province of telecommunications suppliers, and Sigma Data has only recently moved into it from its market base as a computer supplier.

The Infoswitch/ACD system channels

calls to a reservations clerk for immediate attention. If callers have to wait longer than a predetermined period (set by the user), a recorded message informs them of the delay. Calls are then queued and channelled to the first available operator. With the Perth reservations centre handling about 8000 calls each week, this will offer significant advantages over the current manual system.

The ACD system will also enable TAA to determine whether its Perth reservations centre has enough telephone lines to handle the traffic flow. In addition, it will help estimate future requirements.



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# WHY WASTE MONEY ON 'PENNY' ARCADE GAMES?

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We've made a scoop purchase of these computers — together with 10 of the plug-in cartridges. If you want more cartridges (and there are dozens available) or other options such as the programming keypads, these are available throughout Australia at leading department stores.

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## NEWS HIGHLIGHTS

### Dick Smith opens several new stores



Left: the new Dick Smith store at 151 Pittwater Rd, Brookvale. It carries a wide range of marine electronic equipment.

1980 has marked a record year of expansion for Dick Smith Electronics, not only in sales and turnover, but also in the number of new retail outlets opened.

During the past 12 months, new Dick Smith stores have been opened in Blakehurst, Broadway and Brookvale (Sydney), and in Chermside (Brisbane). In addition, the Adelaide store was

relocated in larger premises, closer to the city.

Another two new stores will open soon at 145 Parramatta Rd, Auburn (Sydney) and Dandenong Rd, Springvale (Melbourne). By early next year there will be 18 stores in operation, with a target of at least 25 by 1985.

### Business Briefs:

- **Ampex Australia Pty Ltd** has opened new headquarters at 65 Waterloo Rd, North Ryde. The new premises will be used for spare parts support for equipment sales, customer field service engineering, magnetic tape sales and service, and local magnetic tape manufacturing operations.

- **Rank Electronics** has recently moved to new premises at 16 Suakin St, Pymble, NSW 2073 (Ph 449 5666). The move to Pymble of all NSW activities will allow the company to complete the establishment of its operations as an integrated unit.

- **Tektronix Australia Pty Ltd** has completed major extensions to its headquarters building at 88 Waterloo Rd, North Ryde 2113. Several key executives from the US parent company were present for the official opening ceremony, which took place on October 9.

- **University Graham Instruments Pty Ltd** has announced the appointment of Mr Carew Northcote as Sales Manager to cover their complete range of products. Mr Northcote is well known in the instrument trade, and has spent almost 30 years in the manufacture and sales of electrical instruments. University Graham also advise that their Melbourne sales office has been relocated to 274 Victoria St, Brunswick 3056 (Ph 387 6170). Mr Alan Jeffery has been appointed manager of the Melbourne office.

- Mr Ken Allen has joined **The Computer Company Ltd**, taking up the new position of Manager, Dealership Department. Before joining The Computer Company, Mr Allen spent more than nine years with IBM Australia Ltd as a customer engineer, and subsequently spent almost three years with Tandy Electronics as national sales manager for that company's computer products.

- **Ralmar Agencies Pty Ltd** has moved to new, larger premises at 4 Carlotta St, Artarmon NSW 2064 (Ph 439 6566). The move will enable Ralmar to house all its goods at the one warehouse, and provide showroom facilities and off-street parking for customers.

### Electronics courses at Newcastle Tech

Newcastle Technical College has asked us to advise readers that it provides a wide range of electronics courses for residents of Newcastle and the lower Hunter Valley. In addition, the college offers the Electronics Trades Course in "block release" format for students residing elsewhere in NSW.

Courses available include:

- **Electronics Trades Course** — a 3-year course covering analog and digital techniques for apprentices and others;
- **Post Trade Courses** — television receiver servicing, semiconductor electronics, industrial electronics, industrial instruments;
- **Special Courses** — basic electronics, two-way radio, microprocessor principles, television studio techniques etc.

For further information contact The Senior Head Teacher, School of Applied Electricity — Electronics Division, Newcastle Technical College, Maitland Rd, Tighes Hill, NSW 2297.

### Airborne laser depth sounder

The Australian Defence Research Centre Salisbury (DRCS), South Australia, has developed a new laser airborne depth sounder, which probably places Australia at the forefront in this technology.

Designated WRELADS II, the principle of operation is based on measuring the time interval between the reflection of a laser beam from the sea surface and the bottom. Then, like an echo sounder, this time measurement is converted to a depth measurement since the velocity of light in water is known.

All measured depth soundings must be associated with accurate positional information and the generation of such navigation data, to a few metres accuracy, is an essential part of the system.

WRELADS II is installed in a RAAF Dakota aircraft. Evaluation trials are now in progress over SA Gulf waters.

### Nuclear reactors and safety margins

An experimental gas-cooled nuclear power reactor which is nearing the end of its service life in Britain is to be subjected to extreme operating conditions to test the accuracy of safety margins.

Tests will include running the reactor with defective fuel elements over a range of temperatures, and running at elevated temperatures by increasing the reactor's power and reducing coolant flow. The performance of the core will be carefully monitored during the experiments.



## Advanced solar cell plant for Sydney

A new company gearing up to manufacture advanced solar cells in Sydney is being managed by an interesting pair of Australians: the company director is Bert Israel, who boasts a possible record 56 years in the Australian electronics industry, and the IR&D manager is Dr Bruce Godfrey, 28, who is the only Australian with a PhD in solar cells.

The company, Tideland Energy Pty Ltd of suburban Brookvale, is a subsidiary of Tideland Signal Corp of Texas, USA, a manufacturer of marine navigational aids and robust solar cells for powering the company's equipment.

A project team at Brookvale has embarked on an extensive IR&D program aimed at introducing local production of some of the most technologically advanced, economical and efficient

photovoltaic cells in the world. The University of NSW, where Dr Godfrey recently acquired his PhD, is internationally recognised for its work in improving solar cell efficiency.

The Commonwealth government is sharing the cost of Tideland's research by means of a \$350,000 IR&D grant.

The company is presently assembling US Tideland's solar modules using imported cells. These solar modules are designed to resist the harshest of environments, protect the cells from snap changes from heat to cold, salt spray, moisture penetration, ultraviolet light, hailstorms, dust storms, etc, and have a theoretical lifespan of at least 40 years.

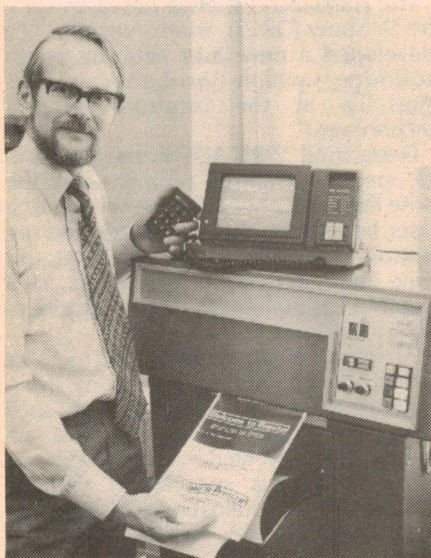
In support of the R&D activity and module/array manufacture, the company is also pioneering local manufac-

ture of state-of-the-art conventional photovoltaic cells. The company will be exporting cells back to its parent and other overseas subsidiaries.

The principal market today for solar power is telecommunications applications. The company hopes to reap benefits here from Telecom's public commitment to a long-term program of using solar power. In addition, solar power is used for navigational aids such as buoy and hazard lights, and flashing beacons.

On the export front the company is developing contacts in South-East Asia where it sees tremendous scope for solar power, not only in the navigational and microwave communications fields but in improving the basic quality of life in small villages.

## The 'Vidiprinter' — for off-screen prints



The Vidiprinter in action!

Developed by a British company, this new combined camera and printer takes high resolution photographs from video screens, automatically processes them, and provides a positive or negative dry print in under two minutes.

Called the Vidiprinter, the equipment consists of a flat-screen video monitor, conventional photographic lens and paper processor within a single cabinet. It is fully microprocessor controlled, and can be remotely-operated using a hand console.

Although its uses have so far been mostly medical — for recording data from X-rays or ultra-sound scanners — the makers claim that it has much wider applications, from printing computer graphics to teledata and TV screen pictures.

The Vidiprinter is manufactured by Tudorcape Ltd, Twyford Rd, Rotherwas Industrial Estate, Hereford, UK.

### TRAINEESHIP REQUIRED

Young man aged 18 just completed HSC. Very interested in ELECTRONICS & COMMUNICATIONS AUDIO & VISUAL fields. E&C student for 1981 would prefer a traineeship to acquire practical work experience. Please phone 969 1448 or 969 1632 in Sydney.

## Telephone answering system has voice recognition

Sanyo has announced the development of a prototype voice recognition telephone answering service that can control home electrical appliances.

The device is capable of switching on or off three different appliances, and allows the user to confirm that the appliances have been controlled according to his instructions. Further, the user can instruct the telephone answering device to play recorded messages into the telephone simply by saying a word such as "rewind" or "play" to the answering device by telephone. It is also possible to use this device to change the contents of an answering tape.

The device is capable of recognising a total of 12 words, including four words for controlling the answering telephone device and six words for controlling power sources to home appliances. Further, it can synthesize a total of 14 words (11 words for confirming the registration of recognised words and three words for giving operation instructions).

## Robots to manufacture robots

Robots to make Robots is the name of the game in Japan. One of the largest electronics manufacturers, Fujitsu, will open a \$40 million factory in 1981 employing 30 robots and 150 humans. It is expected that 350 robots per month will come off the assembly line, as well as other electronic products.

## Robots for the Russians

A recent report in the British magazine "Everyday Electronics" says that the USSR plans to introduce industrial robots over the next 10 years. The program is expected to benefit the West in terms of sales of control systems, at least in the early stages.



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Two unique and valuable components of the Sinclair ZX80: the Sinclair BASIC interpreter and the Sinclair teach-yourself BASIC manual. The unique Sinclair BASIC interpreter: offers remarkable programming advantages — unique 'one touch' key word entry. The ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST etc) have their own

single key entry. Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately, preventing entry of long and complicated programs with faults only to discover them when you run.

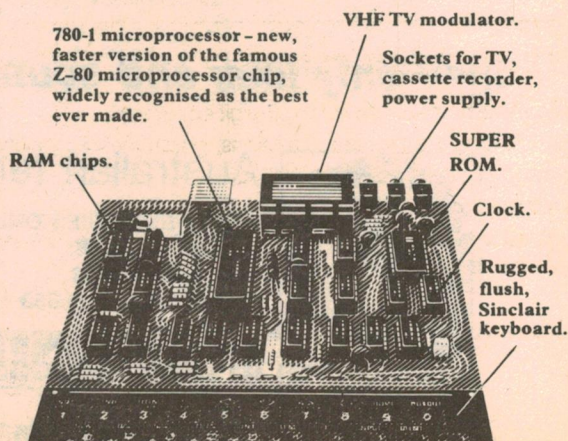
Excellent string handling capability — takes up to 26 string variables of any length. All strings can undergo all rational tests (e.g. comparison). The ZX80 also has string input to request a line of text; strings do **not** need to be dimensioned. Up to 26 single dimension arrays. FOR/NEXT loops nested up to 26. **Variable names** of any length. BASIC language also handles full Boolean arithmetic, conditional expressions, etc.

Exceptionally powerful edit facilities, allows modification of existing program lines. **Randomise function**, useful for games and secret codes. **Timer under program control**. PEEK and

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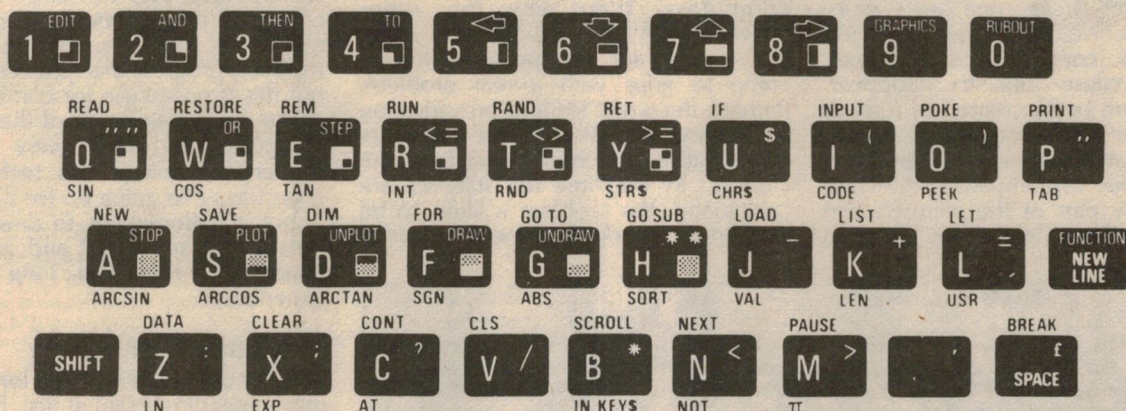


# ZX80

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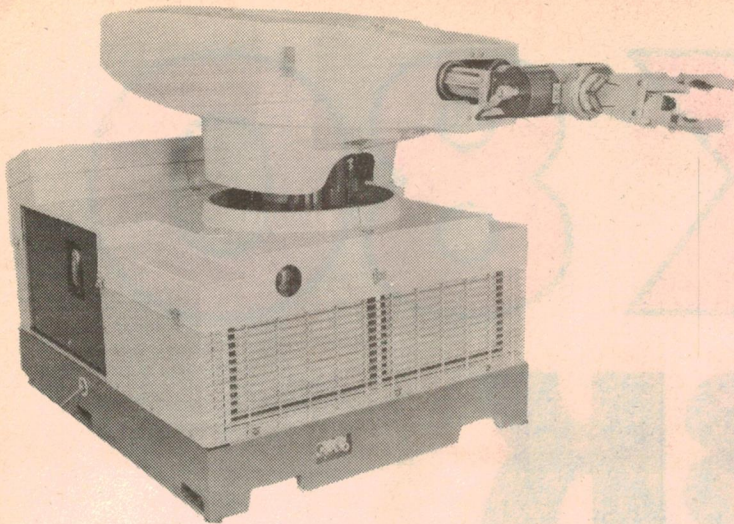
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SE3





# Will take

"Technology creates more jobs than it destroys" — so runs the traditional argument. Nothing could be further from the truth. Modern unemployment is unavoidable, the inevitable consequence of the productive power of modern technology.

## by JOHN M. BLATT

Professor of Applied Mathematics, University of New South Wales, Kensington.

In computer circles, one hears assertions such as, "No one has ever lost a job because of computers", "Whenever computers cause jobs to disappear, other jobs are being created as a result of computer technology", "Unemployment associated with technical progress is not just due to computers, the computer is only part of the picture", and "There is nothing new about technical

progress, it has been going on for centuries, and all attempts to put back the clock have ended in failure".

The first thing to notice about these assertions is their internal contradiction: If no one has ever lost a job because of computers, then why the other statements? All this sounds very much like excuses for not being willing to come to grips with a real problem. Perhaps the worst form of prevarication is the assertion: "We do not have adequate statistics to come to any firm conclusion". By the time the statistics are "adequate", the problem is likely to be well and truly too far gone to admit of

any solution whatever.

One can dispose of these excuses, though unfortunately not of the real problem, in a very few words. Few people have been sacked because of computers — but many jobs have been lost. The semi-skilled clerk adding up columns of numbers quits the job for some perfectly valid reason of his or her own, but he or she is not replaced. Yes, computers create new job opportunities — but not as many as they destroy, and not for the same people. The low skilled clerk is no computer programmer, and cannot be made into one. Yes, there is more to technical progress than just computers — but this is no excuse for computer people to wash their hands of the problem: computers are at the very centre of modern technology. Yes, technical progress has been going on for a long time — but it behooves us to draw correct, not merely superficial and misleading, conclusions from this long historical experience.



*"We have become so enormously productive as a society that considerably fewer than all of us suffice to produce everything needed by all of us."*

## The lessons of history

So, let us indeed take the long view. It may appear irrelevant at first, but please bear with me. I suggest we start by looking 200 years back, to the year 1778. In the Great Britain of that time, as in all other countries then, the vast majority of the population lived and worked on the land, certainly more than 80% of the population and perhaps closer to 90% in most places. Rural productivity was so low that all these people were needed just to feed themselves plus the small city populations of the time.

There has been enormous technical progress in agriculture since then, so much so that the ratio of city to country population has reversed. In Australia today around 85% of the population lives in cities, and the figures are similar for other industrialised countries.

Now let us suppose, for a moment, that it became accepted policy to put people back on the land, say for some social reason such as an ecologically balanced life. Suppose further that this



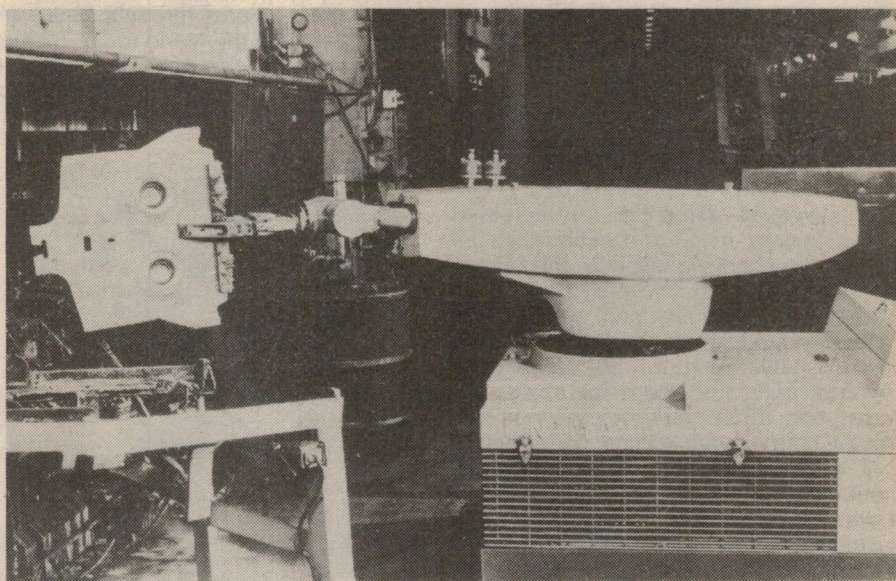
# robots your job?

drive actually succeeded, and 80% of Australians did live on farms and cattle stations, with only 20% left in the cities. Who would then be able to consume all the agricultural product? Who could eat all the feed, use up all the animal and vegetable fibres, etc, produced with modern technology by all these rural producers? Our own population obviously could not do so.

Export it? To the other countries within the same system, such as the USA and the EEC? But they are choking already under agricultural surpluses, and would choke much more if 80% of all their population should be back on the land. To countries outside our system (developing countries)? Maybe yes, maybe no, but in any case this is not an answer, it is an evasion. Looking outside the system for a solution amounts to a refusal to face the facts about the structure of the system itself.

The last 200 years of history should have taught us as our first lesson: a really "great leap forward" in technology (of agriculture) does result in a permanent, irreversible decrease in the proportion of people needed to satisfy all reasonable, or even unreasonable, demands for these products. When I was young, my parents taught me that it was a mortal sin to throw away food. Today, people throw out one-day old bread! In spite of that sinful waste, we are still sending negotiators to the EEC and the USA to get rid of our oversupply.

Our second lesson from history reads: *it is not true that employment was found for all those displaced by the new technology, elsewhere within the system.* Many peasants of old Europe could not be, and were not, converted to industrial workers in the cities of the old continent. Out of a total European population of less than 200 million at the start of the period, 35 millions emigrated to the USA, alone. Indeed, emigration to new continents with free land was the main avenue for the peasant displaced from his ancient heritage in Europe, not industrial employment in European



An early-model Unimate robot at work on a US car assembly line. The auto industry was among the first to use industrial robots.

cities. Many traditional peasants were both unwilling and unfitted to become industrial workers. The fate of the peasant was a sad one, indeed, for he did not find what he was seeking, not anywhere on the whole globe. I recommend "The Uprooted" by Oscar Handlin (Grosset and Dunlap, New York) for a deeply moving, sympathetic account of that fate. It would take us too far here to tell the full story.

The peasants were unfitted for industrial work for many reasons, high among them the traditional conservatism of the peasant, his unwillingness, amounting to practical incapacity, to learn new ways, to do new things. But we must not forget another reason, which it is unfashionable to mention in this progressive age of ours — sheer inability to learn even when trying.

Consider the village idiot 200 years ago, who could not be taught to read and write. Then, this did not matter. Hardly anybody else in the village, stupid

or clever, could read or write, or felt any urge to learn. Our village idiot made a perfectly good shepherd or swineherd, and he could use a pitchfork as well as the next fellow. He was not unemployable, nor alienated from society. He was a useful, working member of the society, contributing his fair share to the total product and none the worse liked for being no smarter than he needed to be.

Now consider this same village idiot in a farming community today. He cannot, and cannot be taught to, drive a tractor, operate a combine, run a harvester. Unable to read and write, and unable to learn, he cannot read directions or warnings of danger in handling expensive machinery. He is not merely unemployed, he is unemployable. Our modern society has relegated the village idiot to the scrap heap of welfare cases. He has two strong arms and two willing hands — but our society can give him nothing to do with them.



# Affluence is increasing, except for the unemployed

Thus our *third lesson from history*: Technological progress imposes an upward change in the minimum level of ability to carry on useful productive work. What was adequate 200 years ago, is entirely insufficient today. What is adequate today, may be entirely insufficient tomorrow; and tomorrow is descending upon us!

## Coping with progress

The new technological revolution is not primarily in agriculture, rather it started in manufacturing industry, and is now invading tertiary industry as well (for example, point-of-sale terminals, computer theatre bookings, and the like). The effect, just as it was in agriculture, is to enable fewer, more highly skilled, people to produce more and more goods and services.

Until the late sixties, the pressure on employment opportunities was absorbed, and neutralised, by a number of effects, not all of them desirable *a priori*: (1) Increased affluence; (2) Increased wastefulness, much of it deliberately induced by changing fashions and built-in obsolescence; (3) The provision of entirely new products and services; (4) Development of entire new "industries", such as advertising, for the sole purpose of increasing the desire for more consumption; (5) Last but not least, war, that most famous and ancient consumer of all. We are frightened, quite rightly, of all out, total atomic war; but little brushfire wars, in Indo-China or Africa or South America, seem to be all the rage. Only when little wars threaten to escalate into big ones, as in the Middle East, is there any real effort to work out negotiated settlements.

What we are seeing now, as we enter the 80s, is the increasing failure of these devices to stem the tide of technological unemployment all over the developed world. Affluence (except for the unemployed) is still increasing, and so is wastefulness; new services and products are still being marketed; and we are not likely to complain of a shortage of advertising effort, or of wars. Yet all these seem to be insufficient to employ our entire population. *We have become so enormously productive, as a society, that considerably fewer than all of us suffice to produce everything needed by all of us, in spite of frantic efforts to redefine what is meant by "need".*

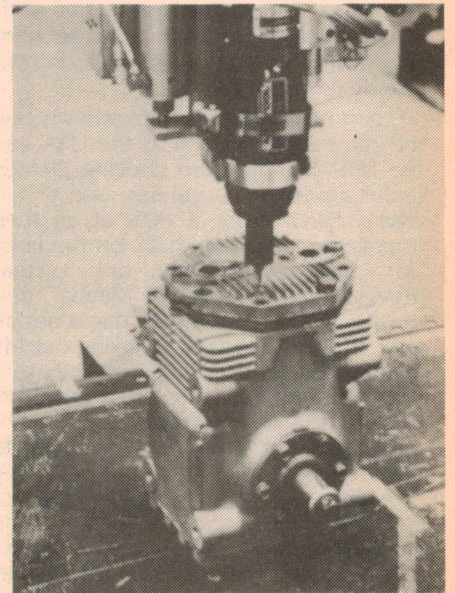
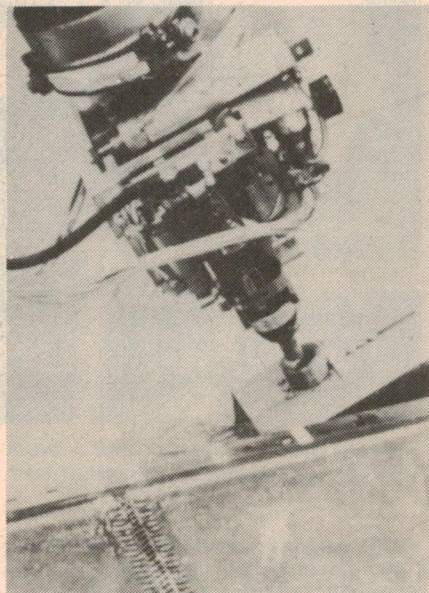
We are floundering in a sea of troubles. Unemployment is large and growing, and the unemployed are so impolite as to refuse to starve to death quietly. They may be losing hope of ever getting a job (probably quite rightly so), but they still wish to eat. A man willing to work, for whom no job can be found, must not be called a dole-bludger. The fact that there are a few real dole-bludgers should not

be used as a pretext to claim that *all* the unemployed are unwilling to work. This is simply untrue, and a lie is a lie, no matter how high the position of the liar.

One does not have to be a radical to foresee serious trouble. A true conservative, valuing stability and order in society, should be the most worried person of all. Some of the unemployed "dole-bludgers", in desperation, are turning to drugs and crime; more will do so in the future. Just how much of this can our society stand, without collapsing into a nightmare world where the streets of our cities, our dwellings and our places of work (for those of us who still have work) become like jungles full of predatory animals, unsafe to live in and unsafe even to pass through? There are cities like this in the world today. Sydney has not reached this stage; but the trend is alarming, and if nothing is done about it, Australian cities are bound to go the

to work with very little, if any, increase in employment. As technical progress runs its inexorable course, all demands, even overstimulated and wasteful ones, can be met with a work force which is only a fraction of our total population of working age. Prosperity for the employed and their employers is worth having, of course; but it is cold comfort to the unemployed.

We *cannot* cure unemployment by "stimulating investment". A climate of increased investment confidence is beneficial to business, and no one argues against trying to achieve this. But it is no cure for unemployment; indeed, investment in fixed capital works *against* more employment. This investment is mainly in labour-saving machinery; even if (the unusual case) the machinery in question is produced here in Australia, the extra employment so gained is small compared to the employment lost after the



Developmental "intelligent" robot at Stanford Research Institute, California. The machine is shown selecting a bolt (left) to fasten down an engine cover (right).

same way. What kind of a conservative is it who stands by and does nothing while the very basis of the society he values is collapsing about him?

## False trails

So, what can we do? Let us start by enumerating what will *not* work.

We *cannot* cure unemployment by "stimulating demand". Increased demand, if achieved, will bring prosperity to the employed and to their employers. But while a few more people may obtain employment through increased overall economic activity, it is most unlikely that this effect could outweigh the effects of technical progress in production. At present, in many of our industries, there is a large excess capacity which can be put

machine is installed; furthermore, the gain is temporary, the loss is permanent. I know of one major company in Sydney that has quadrupled its fixed capital in the last dozen years — but they employ not one man more than they did then. Many companies are getting along with *less* labour than they did 10 years ago, not merely in spite of, but precisely because of, increased investment in fixed capital.

We *cannot* escape our troubles by exporting. The countries that we wish to export to are in the same trouble as we are; the industries best able to export, such as mining, employ very little labour; and much of our labour-intensive industry, for example the car industry, is not "ours" at all: it belongs to foreigners.



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# Modern unemployment is a consequence

Just imagine the reaction of head office if the Australian subsidiary should suggest exporting its product to compete with the product of the parent company or one of the other subsidiaries!

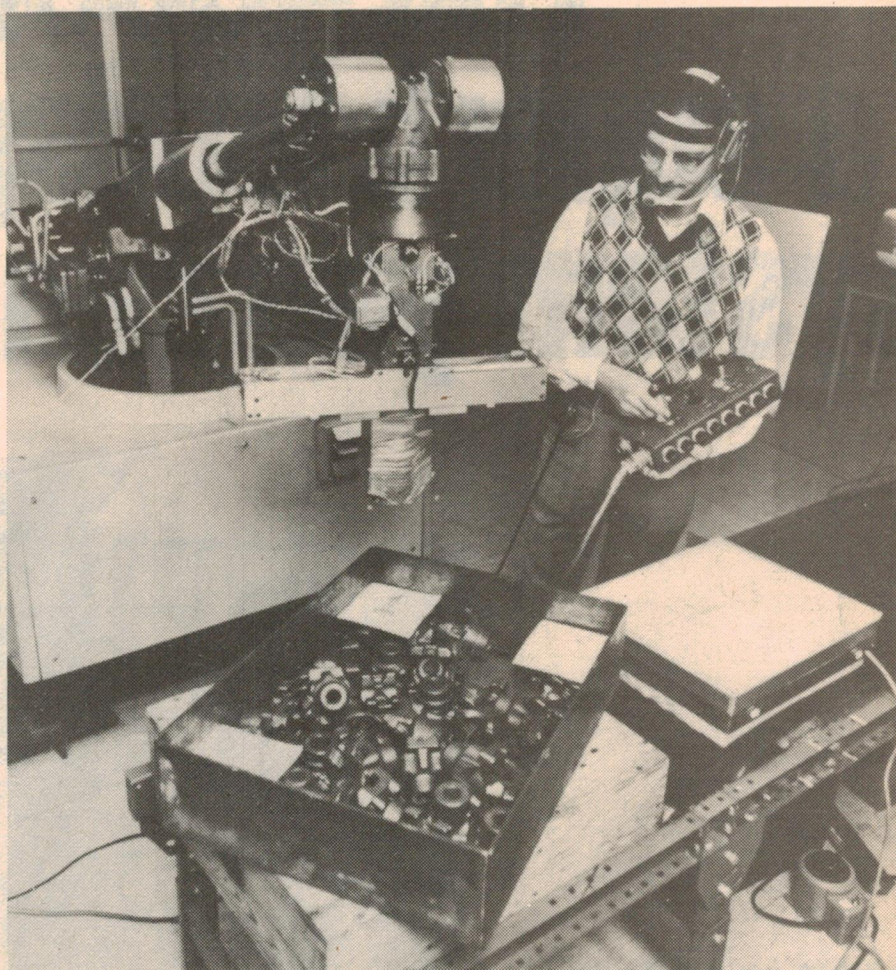
We cannot escape our troubles by reducing the "wage overhang". Of course, real wages can be, and have been, adjusted downwards in the last few years. But these are minor, marginal adjustments. Big adjustments in that direction are neither possible nor desirable. We do not want our nation to live in hovels and work a 70-hour week for bare subsistence. Yet just this is the comparison likely to be made by a transnational company deciding between investment in Australia and investment in certain other countries. No adjustment of exchange rates could possibly overcome this sort of discrepancy.

As long as there are such countries in the world, and as long as investment is decided to such a large extent by big transnational companies, direct protection through quotas or tariffs is the only way industry can survive in a "high wage" country. (Economists, almost to a man, hold otherwise. This is not the place to go into a technical economic argument. Suffice it to quote the experience of the USA. When the Americans, after their civil war, introduced high protective tariffs, English economists ridiculed the economic folly of this brash young nation. Fifty years later, the USA had pushed way ahead of the UK in industrial production, and almost no one in England was laughing. Only economists have refused to learn this lesson, even to this day; but perhaps there is still hope "in the long run", even for them).

But while protection can ensure that we retain industries considered vital for defence or other national purposes, protection *cannot cure* unemployment, unless the protected industries are hopelessly inefficient by world standards — hardly what we want to achieve. If they are efficient, they employ few people.

Of course, machines cannot do everything, and there will still be employment in service industry, such as health care, education, and entertainment. Health care, in particular, is likely to expand rather than contract; and "education for leisure" may give a boost to an education establishment hard hit by the demographic trend to lower birth rates. However, while these jobs cannot be done by machines, neither can they be done by "village idiots" (new style). Not everyone can become a trained nurse, a teacher, or a star musician. In service industry, as elsewhere, jobs for people with special skills and abilities are safe enough — it is the low skilled jobs that are threatened by technology.

Perhaps the most immediately appeal-



Overall view of the "intelligent" robot developed at Stanford Research Institute. Here an operator trains the system to identify the corner positions of a bin.

ing measure, though rather radical in the view of some, is to spread the work by a drastic reduction in working hours, say four hours per day instead of eight. But even this will *not* cure unemployment. The reason is the "village idiot" effect. As we move into the supermodern age of computers, more and more of us are becoming classified as village idiots, essentially unemployable, unable to absorb the training required to make us able to take an active part in this form of production. In spite of the shibboleths of our "educationists", it is simply not true that all of us are equally capable of learning to become computer programmers or maintenance engineers, to say nothing of more advanced areas of computer science. A very significant fraction of the population can be taught little more than simple coding, if that. And simple coding is being outmoded rapidly by the progress of software technology.

An interesting point in relation to service industry employment is that so much of it is government employment. The government, not private industry,

runs hospitals, education, and even much of entertainment (think of the ABC). The thought that this may be the main, or even the only, area of expanding employment in the future might well give pause to over-enthusiastic proponents of the ability of free private enterprise to solve the unemployment problem.

The easy options, the conventional options, are running out. All these approaches are failing, and will continue to fail, to cure unemployment. *Modern unemployment is basic, structural, and inevitable. It is an unavoidable consequence of the overwhelming increase in the productive power of modern technology.*

## A way out?

The main purpose of this article is to insist that we are facing a real problem, that we must ask the right questions, and that we must not accept evasions or sham answers. It would be idle for me to claim, and I do not claim, that I have a ready-made answer.



# of the productive power of modern technology!

However, I believe it would be wrong to leave the matter the way it appears at the end of the preceding section. If our question is, "What can we do to create more employment?", then the present situation does look utterly black, with no way out of the tunnel.

But is that the right question? Sometimes it pays to step back from a problem so as to get a bit of perspective. Looked at from a broader, human point of view, is it in fact such a disaster if we cannot "create employment" for everyone? What we really have here is the fulfilment of one of the most ancient dreams of mankind: *Abundance for all, with plenty of time for leisure and enjoyment, without hard work on the part of anyone.* We now possess mechanical slaves, amazingly fast, efficient, and becoming ever more intelligent, who can be made to do all the routine tasks of economic production. The slaves require only instructions about what to do, and occasional maintenance. Human beings should be able, individually and collectively, to relax and enjoy the rich and easy life.

We have all been brought up to believe that man cannot live without working. "In the sweat of thy brow shalt thou eat bread, till thou return unto the ground." We have all heard stories about the degeneration of Roman population, fed on bread and circuses with all the work done by slaves. Abundance for all, without working, seems to us less a pleasant dream than a nightmare.

But how much of this reaction is "human nature", and how much mere conditioning in our youth? Is it really true that man cannot live without spending a major fraction of each day at an assembly line or in an office? Even if our genetic make-up includes a desire to earn our living, surely there is nothing natural or genetically appropriate about the sort of work most of us do nowadays?

It is quite true that man needs a purpose in life, he needs something important to do. But that something need not be paid work for economic production. Elaborate religious rituals, sporting contests, art music and theatre, dancing, etc, have all been taken very seriously by men at many times, in many places. Is it so obvious that they cannot possibly, in the future, take the place of the assembly line and the office? Man needs to have a living, of course, but he can do quite well, thank you very much, without working for it in the sweat of his brow.

Indeed, it is by no means true that all of us earn our living by hard work. Much office work, not only in government offices but also in the offices of big corporations, is exceedingly leisurely, to put it mildly. We hear regular complaints about waste of taxpayers' money by an overblown and inefficient public service

bureaucracy. There is less complaint about overblown and inefficient corporation bureaucracies, but few would deny their existence. Nor is "featherbedding" an unknown practice in blue-collar circles. One could argue that a significant number of people "earn their living" right now without exerting themselves unduly.

Far from being undesirable, it seems to me that this represents a sensible and practical adjustment of our society to the realities of technological progress. We are not ready, yet, to accept the full logical consequences of our vastly increased material productivity. People must be "employed" at something, before they are accepted as full members of our society. So, we "employ" many of them to do next to nothing, to push around meaningless pieces of paper from office to office, to act as third man or fourth man on a device which can be operated quite effectively by one man, and so on. The net result is to keep up employment, without flooding the market with additional real goods way in excess of demand. As a halfway house, this is quite a reasonable way out, in spite of (or perhaps precisely because of) its logical inconsistency. There exist other forms of temporary adjustment, for example proposals for permanent part-time work and other forms of sharing employment. For the reasons given earlier (the village idiot effect) these are not permanent solutions, but who are we to scoff at anything which gives at least some temporary relief?

In the long run, though, why should men be "employed" when enough can be produced for all, by a small fraction of the population of working age? What is wrong with allowing people to live their lives and use their allotted time on earth in accordance with their own desires, not beholden to some boss for the best hours of every day? Naturally, such a fundamental change of attitude cannot come overnight. It requires a complete reversal of beliefs that many of us still profess fervently and do our best to instil into our children by education. But there is nothing inherently impossible about such a change coming about eventually, under pressure of circumstance and inevitable necessity.

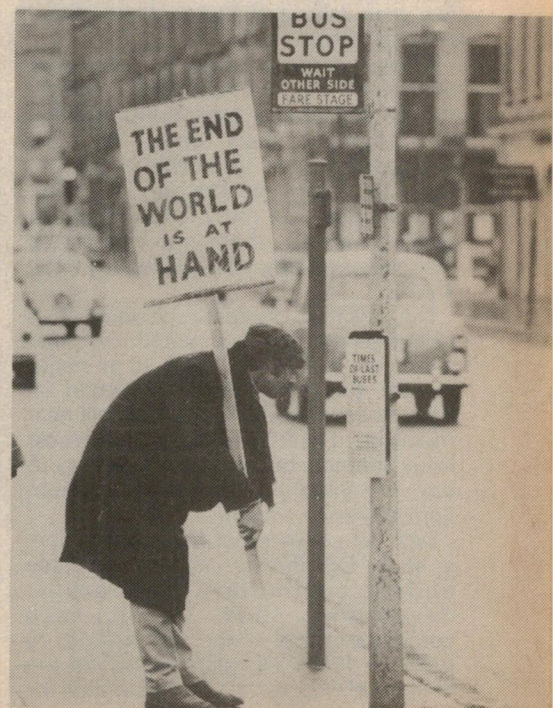
I can foresee a glimpse of a future in which people are paid a living allowance, enough to buy not only necessities but substantially everything they may reasonably desire to have; paid this allowance as a matter of basic human right, not by virtue of doing economic work. Just such proposals have already been put forward in the USA, under the heading "guaranteed minimum wage", and I believe we shall hear more of them in the future. A few people, with special abilities and advanc-

ed training, suffice to keep economic production running, the production itself being carried out almost entirely by machines. Some other people, again with special abilities and training, will be employed in various service industries. But ordinary productive employment of the sort we think of nowadays as normal, may become such a scarce commodity that people, without special abilities but with a burning desire to be employed somewhere, may have to pay for the privilege. I suspect very few will wish to do so.

In my view, it is a mistake for computer people to mouth apologetic phrases about what is happening to employment. We are going through a time of transition, and such times are always difficult. But fundamentally, there is nothing to apologise for. Employment *should* be abolished, people *should not* be forced to work just in order to be able to eat. Abundance for all, without working, is within sight of our generation. We now have, or will have very soon, the technical capacity to produce, quite literally, paradise on earth. We lack only the understanding and the will.

The author would like to acknowledge valuable comments from many people, including Dr Brian Burn, Profs W. Ford and M. Kemp, Dr Helen Murphy, and Mr R. W. Rutledge. The opinions expressed here, however, are entirely the author's responsibility.

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# Fifty years of talking pictures Pt. 2

*In Pt 2 this month, the author continues his reminiscences of the early talkies era. He describes a typical installation, and relates some interesting stories from the period.*

**by G. M. NEALE**

34 Madeleine St, Glen Waverley, Vic 3150.

To illustrate the bizarre state of sales and installations at the time, there is no better example than the Victory Theatre, Malvern. This theatre was one of those old square box-like halls seating about 800. Into this old, austere, theatre went the largest equipment RCA produced in America; an equipment that would have well catered for any of the big theatres in the capital cities seating 3200. I did hear that it had been earmarked for the Regent, Adelaide; however, irrespective of what transpired, the Victory ended up with the equipment.

The equipment was designed for a supply of 460V DC, and this would have suited several of the capital cities at the time, but not the suburbs. The early systems required battery supplies or DC generators. It was not for some four to five years (about 1933/34), that rectified AC was introduced.

[It may surprise some to learn that Melbourne had a 460V DC electric supply well into the late thirties, (though the suburban areas were AC). The arrangement was somewhat similar to two 230V DC generators in series. Lighting came off the 230V, and motor power, other than for fractional horsepower types, was derived from the 460V].

The Victory system included two motor-generator sets wired so that either set could be used. In a major theatre, the motor-generator would be running continuously from 10am till near midnight, in which case they would most likely alternate between sets from day to day. The Victory running time was from 7pm till near midnight.

Each set consisted of four units in line; a 460V DC driving motor, a double ended commutator generator developing 500V DC at each commutator and connected in series to produce 1000V DC plate supply for the final amplifiers, a 24V DC generator for

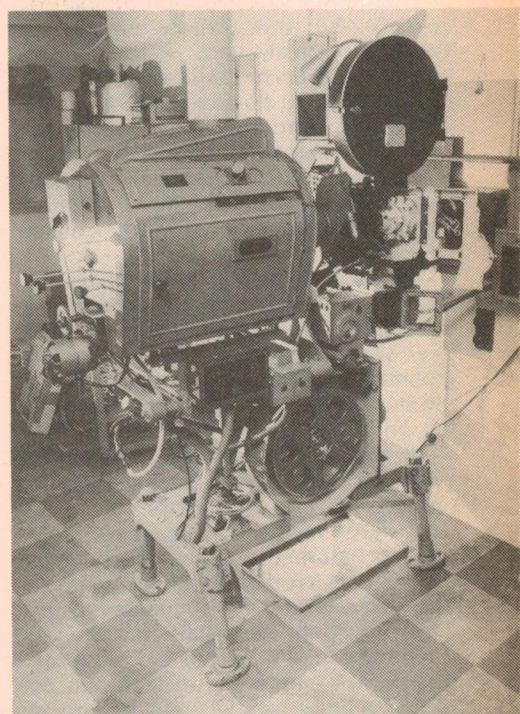
speaker fields and signal lamps, a 12V DC generator for filaments etc.

The supply to the theatre in those days was 430V/215V single phase AC. The 460V DC necessary to supply the two motor-generator sets mentioned above was generated with yet another motor-generator, built locally. The 460V DC motor was arranged with the armature shaft extended either end and a generator coupled either side, with the fourth generator in line and beyond that again. It was not a simple matter to replace the motor with a suitable AC one, but it was comparatively easy to have an AC to 460V DC set made up from good second hand units.

To complete the machinery room there was a fourth motor generator AC/DC providing 110V 180A DC for the arc lamps, and an engine driven generator to supply the arc lamps should the "town" supply fail. This was left over from the silent days; should the town supply fail in the talkie era, that was the end of the show; very few theatres ever installed stand-by AC generators.

At that time, I was not familiar with the principles of audio amplification. The difference between voltage amplification and power amplification had me tossed, for the circuits looked much the same. In any case I was still trying to sort out three phase, single phase, etc. First things first. However, I recall there being four large valve sockets in the middle of the amplifier rack, unused. I was told at the time, there was enough power available from a previous stage to operate the speakers, and so the final output valves in this magnificent equipment were not needed. I have often wondered whether the 1000V plate supplies were then necessary, or whether the previous stage required something much less.

There were many experiences in those early installation days that appeared anything but funny at the time. We had a lovely little theatre at Glen Huntly, modelled on the Spanish style and not long built, in which an RCA equipment was to be installed.



An original Western Electric "Mirror-phonic" universal sound base fitted with a later model Simplex projector. The "sound-on-disc" turntable has been removed, but would have extended from the lower shelf, behind the rear legs.

The theatre featured textured plaster walls coloured appropriately, dark oak beams, heavy drapes, and much carpet. The whole of the auditorium ceiling was dome-like and coloured to resemble a blue night sky with many stars.

Installation blueprints included the schematic arrangement for screwed conduits to be run between the box, the apparatus room, the stage, and the main switch room. The box was at the rear of the dress circle while the apparatus room was at ground level and some distance from the main switch room, also on that level. The drawing indicated a number of runs of conduits in specified sizes.



The electricians went to it, hauling down heavy curtain drapes (which later became very useful to curl up in for a few hours sleep), pulling up carpets and floor boards, knocking holes through brick walls and dislodging plaster, to install the conduits. Following in haste, were other tradesmen to repair the damage.

When the time came to feed the cables through the installed conduits, it soon became obvious that the conduits were too small, though they checked out correctly with the drawings. What was not appreciated was that American conduits are measured (and most sensibly), by inside diameter, whilst British and Australian are given in outside diameter. The whole procedure of wrecking and making good had to be gone through again.

This, perhaps, was good example of a lesson to be learnt in marketing. Had this been a Western Electric contract, there would have been a WE engineer on the job supervising the electrical contractor from the start. As it was an RCA installation sold outright, the pre-installation requirements were carried out to specification alone. The RCA man turned up only to terminate the cabling, get sound through, and commission the system.

Another occasion that comes to mind was of the application of a stroboscope to check out the speed of 78rpm turntables. I would go so far as to say very few in the electrical industry had even seen a stroboscope; most turntables were spring driven, and if there was a speed correction to be made it was made by ear.

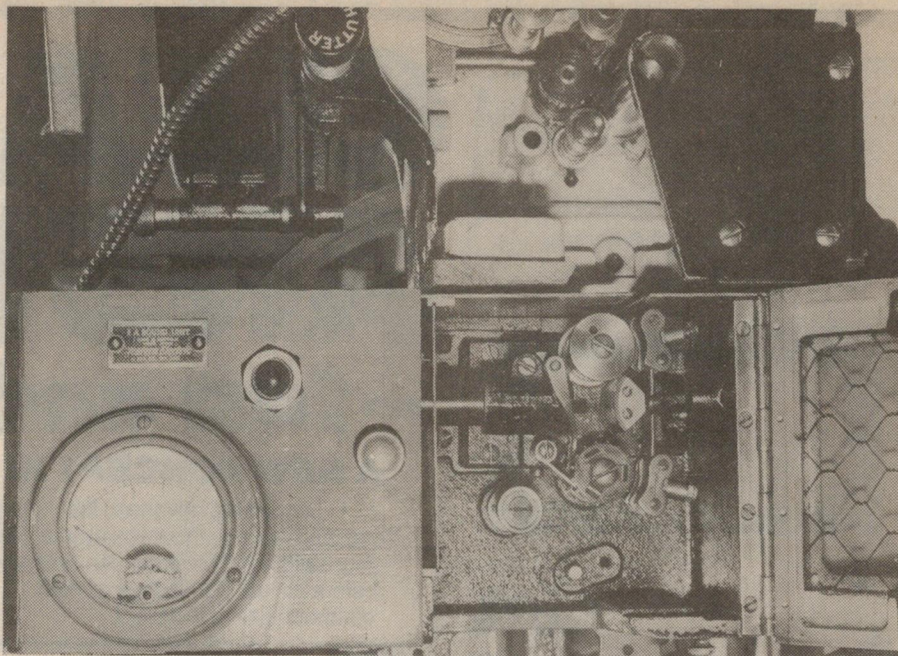
In this particular instance a cardboard disc type turned up in the packing case with the dual turntable used for incidental music. The projectionist, having read the directions on the reverse side of the card, thought he would put it to test. Up until then, the reproduction had sounded normal, but on spinning the stroboscope disc, the segments were an indistinguishable blur.

Adjustments were then made to the ball governor until the black and white segments were stationery. However, reproduction from a record now sounded anything but right. The mechanical adjustment was reset to the original position, checked out by ear, and left at that.

What was not understood at the time (and perhaps for a long time after), was that the stroboscope was designed for 60Hz lighting, as in America, and not for the 50Hz supply in this country.

My favourite story is one as told to me by Vic Mason, one time with Western Electric. Vic completed an apprenticeship as a dockyard electrician in the late twenties, applied for a position with WE (Sydney) and was duly accepted.

To quote his own words — "I reported on the Monday morning fully expecting to sit in on some formal schooling, so it



*A close-up of the Mirrorphonic sound head, which sits just below the projector mechanism. The meter at left monitored the exciter lamp current.*

came as a shock when the chief said, 'We are terribly busy with installations Vic; here are the handbooks and circuits, go down to the store where you will see equipment unpacked and find out what you can by reading and looking at the gear. It would be an understatement to say I was bewildered.'

"From time to time during the week, some of the engineers would flee in and out and possibly spare 10 minutes explaining a point for me, though I was quickly becoming snowed under with the new technology. Till then I had never been in a projection box, and knew nothing about sound amplification.

"By midday Saturday, I was well aware

that talking picture technicians observed a seven day week (with six nights) so I thought it prudent to hang on for two or three hours after lunch. About four o'clock, when I was about to leave, the chief came hurrying down and said, 'Oh Vic, I am glad you are still here. Just had a ring from the Roxy, Broadway. They have lost sound on one machine and had to refund the matinee kids their money. Grab a cab and see if you can put them right for tonight's performance.' I protested, but it was laughed off. 'You'll be right Vic, give us a ring if you are not getting anywhere.'

"When I arrived both the manager and the projectionist led the way up to the

*Below: An operator sets up a disc on the Western Electric sound "reproducer set".*





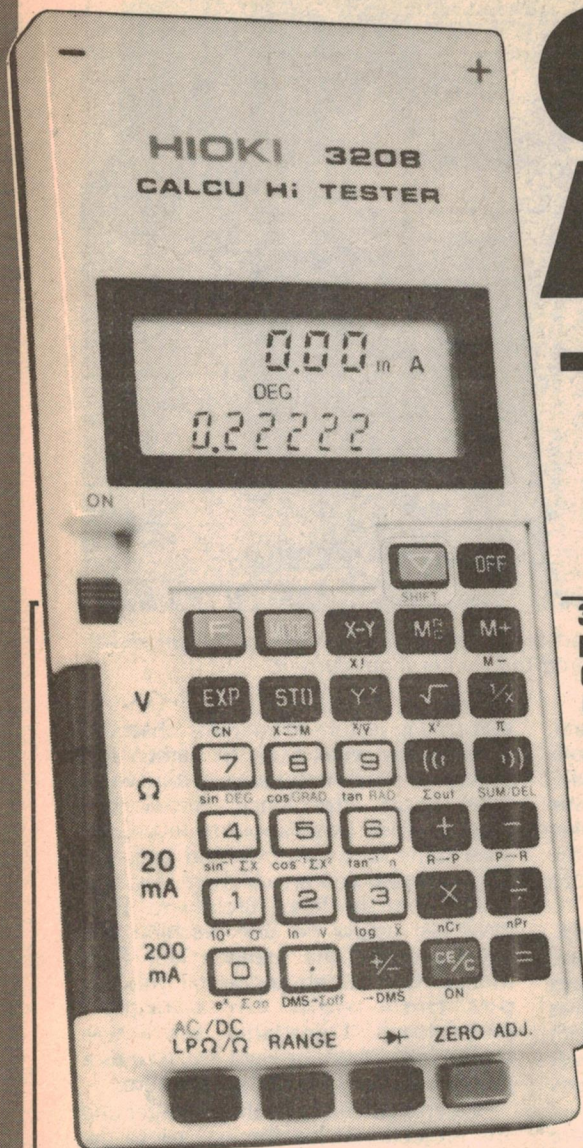
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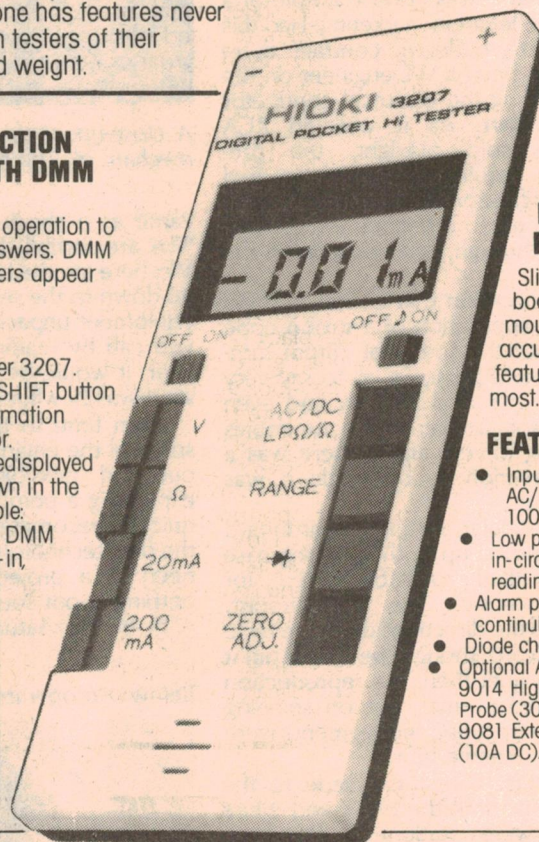


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- DMM features refer 3207.
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- DMM figure is redisplayed in the form shown in the following example: When 190.0mV DMM display is keyed-in, 190.0 $\times 10^{-3}$  is displayed.



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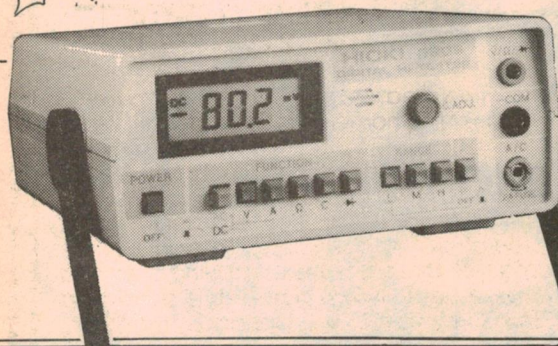
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- Input impedance AC/DC 10M $\Omega$  and 100M $\Omega$  on 200mV.
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- Measures capacitance 0.001 $\mu$ F to 20 $\mu$ F.
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# 50 years of "talkies"

box. As soon as we entered, the projectionist demonstrated how, on switching to the left hand machine, and turning the fader up, there was plenty of background noise but, on transferring to the right hand machine, the system was dead. I was wishing the hell they would both go and let me follow through the handbook from step one, though it was just as well for I didn't even know how to switch on.

"By this time I had put on my dust coat and unfastened my brand new tool bag with 'Western Electric' on it in gold letters. The fader was left turned full up on the dead machine. I remembered reading that all wiring to the amplifier rack was routed through the 'A' junction box and this included battery supplies. In order to make some impression I couldn't think of anything better than to measure the battery voltages in the 'A' box.

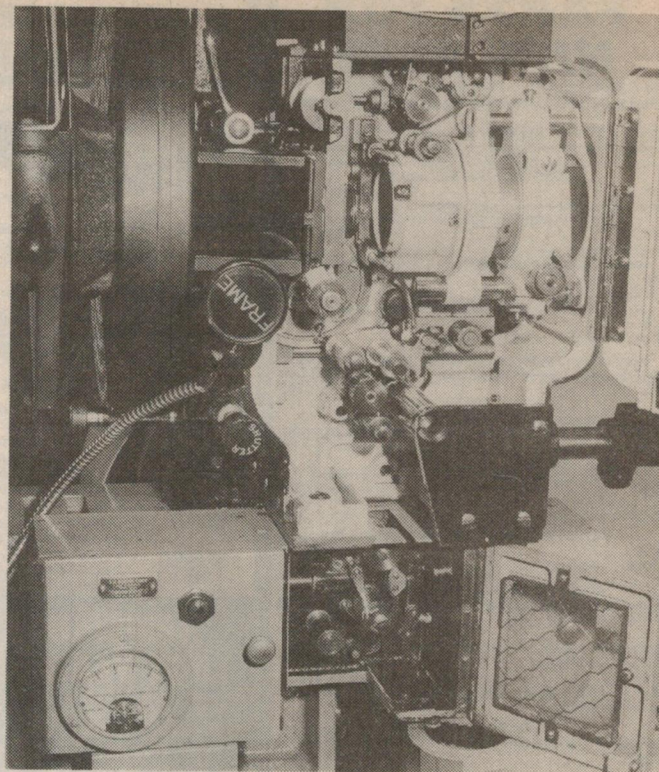
"This box was about six feet above floor level, and on the floor below was a simple flat-top sheet metal 'black box', which seemed just the correct height to stand on. I had no sooner put my weight on it, when a crackling roar came from the monitor speaker, frightening the daylights out of us all. The projectionist quickly established that he could turn the noise down with the fader, and it became apparent the failure was somehow to do with the box I was standing on.

"I proceeded to make the DC measurements, thinking all the time, what the hell can be in the box I am standing on. Plate resistors, grid resistors, coupling condensers, filter condensers, bias, many many soldered connections — all flashed through my mind. If only those two people would go.

"There was no way out. I could see by their expression and the way they both eyed off this black box, that the trouble must be in there. So, with my heart going thump-ity-thump, I lifted the lid of the box and there, looking me square in the eye, were two dry batteries and a wire to one of the spring clips, which had come adrift. Nothing more, nothing less. I put the wire back and sound was restored.

"I didn't know it then, but I was dealing with the 90V HT to the photoelectric cell. I took the opportunity of checking out the location of the power supplies (110V AC, batteries, etc), switching, along with the system transfer key switching, pilot lamps, meter reading and so forth, and I guess that small bit of 'trouble shooting' gave me as much confidence as a week in a classroom."

How true that is. Many engineer-technicians have been shaken when confronted with complicated equipment for the



Close-up of the Simplex projector mounted on the universal sound base. The base was designed to suit a variety of silent projectors, of which an earlier Simplex and the Powers were the most popular. (All photos courtesy MCA Australia, 23 Pelican St, Sydney.)

first time but, once having gone through a service exercise, the procedure appears infinitely simpler each time.

To digress from the talking picture world for a moment, my thoughts go back to 1943 when I was one of four inexperienced technicians fresh out of radar school. We found ourselves on the other side of the world — a long way from instructors or technical friends — and solely responsible for the readiness of no less than 12 radar systems in HMAS Shropshire.

I knew how poor old Vic felt; none of us had even seen the equipment before, except on paper, and there was plenty of top brass to play the role of the projectionist and theatre manager.

3

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If a kit you want to build is not listed, the parts may be available anyway. Check the Dick Smith Catalogue or call in to your nearest Dick Smith store.

**NEW EA MOSFET STEREO AMPLIFIER** (See EA December)  
Final details for this superb kit are being finalised at the moment. Look for our special adverts in next month's magazines.

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PCB ..... Cat. H-8384 \$3.00  
All other components are normal stock lines.

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PCB ..... Cat. H-8385 \$2.25  
All other components are normal stock lines.

**NEW ETI 5000STEREO AMPLIFIER** (See ETI December)  
PCB ..... Cat. H-8387 \$9.95  
(Fibreglass board)

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PCB ..... Cat. H-8383 \$1.90  
All other components are stock lines.

**ELECTRONIC MUSIC GENERATOR** (See EA December)  
Complete kit, including instructions ..... Cat K-3512 \$12.50  
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Short form kit (All components & PCB) ..... Cat K-3325 \$16.50  
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We stopped doing this, but it seems we made a very wrong move. So many people have asked for our below cost special, each month that every one of our store managers has demanded they be reinstated. As we don't want to lose our store managers en masse (or our customers!) we're going to start our special again next month. So from January call into your nearest Dick Smith store and check out our below-cost special.

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When it's important, don't rely on your memory. Tape those important conferences, sales meetings, interviews, etc. for later reference. This budget-priced recorder takes standard cassettes, and operates from its own batteries or external plug-pack adaptor. It features a review button for instant checking of recording. Also has fast forward and pause controls. Too. Comes with built-in electret microphone, case & earphone.

**\$45.00**

Cat A-4050



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**\$47.50**

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ADD-ON DIGITAL DISPLAY KIT IS ALSO AVAILABLE FOR EXISTING FT-101Z CONVERSIONS: Cat D-2861

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YES! With every FT101Z, we're including a digital frequency display kit, normally worth \$139.00, at no extra charge! It's a simple 'drop-in' replacement display, any ham can install it in an hour or so. Full installation instructions are included. You know how good the FT-101Z is: now it is even better: it becomes an FT-101ZD for the same price! Offer is open strictly while current stocks last: be quick for this bargain.

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**FT-101Z (Cat D-2862): \$775.00**

**Digital Disp. (D-2861): \$139.00**

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(at about 6AM on Thursday, 25 December - as the kids unwrap their Christmas presents...)

Imagine! All those battery operated toys and no batteries to run them. Wouldn't you be popular?

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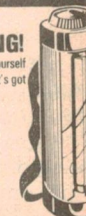
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- An emergency orange flasher

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**\$3.90**

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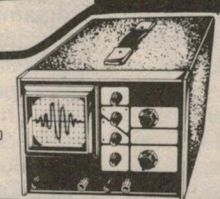
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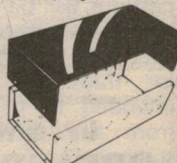
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THE SLOTS!**

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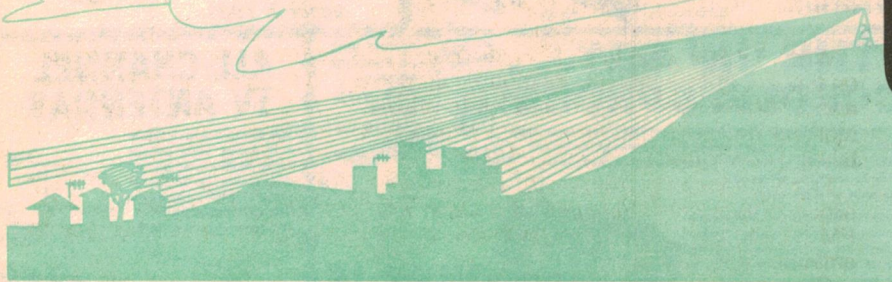
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# Coming to grips with UHF TV



by NEVILLE WILLIAMS

*The above sketch, from a Hills Industries publication, serves to emphasise the essential line of sight character of UHF TV signals.*

At a well attended seminar in the studios of TV Channel 7 in Sydney, representatives of the television industry and the technical press were able to sort out a lot of the confusion surrounding the introduction of UHF television services. While the discussion centred on the Sydney scene, the basic facts apply nation-wide.

Sydney's first major TV service on UHF (Ultra High Frequency) was launched a few weeks ago with the commencement of multi-cultural programs on channel 0 (VHF) and channel 28 (UHF) — 526-534MHz.

Channel 28 is a powerful transmitter in its own right, sharing the same mast as the ABC's channel 2. Its mass coverage has yet to be demonstrated because few viewers have, as yet, installed the so-called "Band IV" antennas necessary to receive stations in this part of the spectrum to best advantage.

However, by the time this issue appears on sale, it is highly likely that test patterns will be on air from three more UHF transmitters, further up in the UHF spectrum — "Band V". These transmitters (or translators, to be precise) are intended to re-transmit the programs from the three Sydney commercial stations 7, 9 and 10. Provided no technical hitches occur, it is possible that program transmission may commence within days of you reading this article.

This new set of UHF translators, installed on the roof of the Kings Cross Hyatt Hotel, are intended to serve harbourside suburbs and the congested inner south-western areas of the city, which are partially shielded from the present VHF transmitters.

It is likely that, within a matter of months, additional translators will be installed on the top of the Hyatt, to carry the programs of ABC channel 2 and the multi-cultural channel 0/28. The installation has been planned on that assumption. In longer term, it has been envisaged that up to 8 channels may have to be accommodated.

As noted elsewhere, the Hyatt

translators are intended to provide alternative access to the parent station programs, and the directivity pattern of the multi-channel transmitting antenna has been arranged to concentrate the signal into specified target areas. If the signal happens to be accessible to receivers at vantage points elsewhere in or around the city, that is purely incidental. In such locations, good signals would normally be available from the parent transmitters anyway.

Based on their experience in Adelaide, representatives of Hills Industries Ltd (an Adelaide-based antenna manufacturer) stressed to the Channel 7 symposium the strict line-of-sight character of TV transmissions at UHF.

At VHF, a certain amount of bending and bouncing is expected. Therefore, over the gently undulating topography of most suburbs, the tendency is to erect a VHF antenna in a reasonably clear (but not too awkward) vantage point and expect a satisfactory signal. A distant hill, a few modest buildings or the odd tree or two in the transmission path are of minor consequence.

But not at UHF. A direct line of sight from transmitting to receiving antenna is the only real guarantee of good pictures. If hills, buildings or heavy foliage interrupts the line of sight, the signal may suffer severely.

To quote a specific example from the Sydney scene, predicted coverage from the Hyatt translators indicates that the Pyrmont area — not a good place for VHF — is also shielded from UHF by the high rise buildings through the centre of the city.

Similarly, a small area near The Spit, which could well use a UHF service from

North Head, is shielded from it by the intervening peninsula (Dobroyd Head, etc).

The Hills representative also pointed out that it is essential to be more discriminating when installing domestic UHF TV antennas. They should be external to the building, preferably up in the clear and on that side of the structure which faces the transmitters. It is possible to lose most or all of the signal by mounting the antenna even marginally behind and below the ridge of a metal or foil-lined roof.

Even a large, dense tree can play havoc with the signal.

Whereas a "roof jockey" may erect a VHF antenna on the basis of "that orta' be right", anyone handling UHF installations should use a field strength meter on the roof, as a matter of course. That way, the position of the antenna, and even its height, can be made the subject of observation, to determine an optimum point where the signal on all stations is adequate and reasonably uniform.

It was also pointed out that, whereas VHF antennas might involve as few as three or four elements, apart from the boom, a basic primary-area UHF antenna might typically have 10 elements, all much shorter, of course. For difficult or longer-haul situations, the number of elements may double.

Also, because of the extra elements, UHF antennas are usually quite directional and it is important that they be lined up exactly on the source transmitter(s). Where the transmitters are not immediately visible, the wise installer will use an on-the-spot field strength meter. It is likely to be far more precise than a shouted query "ow's that?" to someone watching the TV screen in the house below.

Questioned about indoor antennas, the Hills representatives were anything but enthusiastic. An antenna inside a foil lined gable is likely to be useless, unless it is looking directly out through an



unshielded end wall. But even that is unpredictable, because tiles and bricks can become wet and, worse still, fouled with ocean salt or other pollutant.

Antennas inside the room may work in high field strength areas but they will always be prone to standing wave effects created by furniture, metal blinds, occupants, etc.

The panel was questioned closely about the choice of down lead. It was noted that Japanese receivers commonly provide 300 ohm terminals for both VHF and UHF antenna connections, with a terminal-type 75 ohm option for VHF only. This would seem to indicate a clear preference for ribbon down lead for UHF.

European (and British) receivers, on the other hand, go to the other extreme, with a single 75 ohm coaxial connection and an internal splitter to feed the VHF and UHF segments of the tuner systems.

This practice is now standard in Australia although, over the years, receivers have appeared with 75 ohm coax connectors, one each for VHF and UHF.

Opinion at the seminar was firmly in favour of coaxial cable, rather than any kind of open ribbon. It was pointed out that while ribbon appeared to exhibit lower transmission loss at UHF, this was really only valid for "laboratory" conditions. In the real world, where ribbon was exposed to the weather outdoors, and followed tortuous paths to the receiver indoors, losses tended to mount and reflections build up from sharp bends and proximity to other metal conductors and surfaces.

It would be a particularly dubious choice for suburbs where wind-borne salt spray could be encountered.

## QUALITY OF CABLE

Ordinary TV coaxial cable should be satisfactory for most installations, provided the cable is not notably lossy or has not deteriorated as a result of age and exposure.

It was stated, as a rule of thumb, that the transmission loss in Band V (eg at 800MHz) is about twice that at VHF (eg 200MHz).

For longer runs, it is good practice to use cable which has lower than average loss, particularly in areas where there is any apprehension about the strength of available signal.

When installing the cable, it is wise to avoid kinks or very sharp bends, because they can create internal reflections, with possible phasing effects and granulation of the picture. Use proper connectors and avoid "bodgie" joints for the same reason. And note also that combiners, splitters, baluns, etc must be UHF compatible. Existing VHF hardware may or may not be so.

Companies and individuals involved in UHF antenna installations will have to consider each case on its merits.

It may be appropriate, for example, to

## WHY BOTHER WITH UHF TV?

Why are we fiddling at all with our TV systems? Why do we need UHF translators? Should we not have gone for an all UHF service in the first place? These and other questions are flying thick and fast as the new outlets come on air.

When TV first went to air in Australia in 1956, national planning was based on the use of 10 channels distributed across the VHF spectrum between 56 and 215MHz. But public response to television, and the pressure for more stations was such that three extra channels were added — 0, 5a and 11 — taking in frequencies down to 45MHz and up to 222MHz.

From the outset, there were arguments about the precise frequency allocations, notably because of a clash with frequencies normally used for FM broadcasting, and also because of the proximity of some channels to amateur radio bands.

On the positive side, VHF stations have brought television into most homes, in a country which has a mix of very awkward situations: vast distances, crowded urban areas, and large pockets of population on steep slopes facing waterways and the ocean. The fact is that VHF transmissions do have a fairly long reach and do have the ability to bend and bounce enough to fill in many of the shadowed areas.

Topographical difficulties are especially evident in Sydney, with its half-circle of distant suburbs, its congested and high-rise heart, and its complex pattern of beaches and waterways. Hundreds of thousands of viewers in these last-named areas can receive only indifferent pictures. In recent years, the problem has been the subject of considerable research, both by station managements and by the relevant Federal Government instrumentalities.

Having looked at the possible options, the decision was reached to implement one that had been foreshadowed to the industry in the early '70s, coincident with the planning for colour. This was to supplement the VHF TV service, where necessary, with transmitters and/or translators operating at UHF. In fact, UHF translators have been operating for some time in certain rural areas and in Adelaide.

Following the decision, exhaustive topographical studies and field strength measurements were undertaken in the Sydney area and plans laid to cover the areas of greatest need with two groups of translators — one situated on top of the Kings Cross Hyatt, and the other on North Head. Directive antennas were planned and translator power determined so as to serve the target areas to best advantage; this, with a minimum of overlap, or spillage into suburbs not requiring a supplementary service. Maps were produced showing the calculated service areas.

It has become apparent from the studies that there are many other pockets of population in the Sydney area which could benefit from a translator service and the authorities are keen to ensure that present and possible future translators do not cause mutual interference. One thing that has become obvious is that the available UHF channels can be taken up quite rapidly in a city like Sydney and forward planning is essential. Indeed, in small localised areas, it may be appropriate to opt for a community receiving antenna and cable distribution.

The first installation to be commissioned is that on the roof of the Kings Cross Hyatt Hotel and this will serve harbourside suburbs to the north and north-east of the translator, and the congested area around the central city, with further lobes towards Edgecliff and Redfern.

The North Head installation is quite another story. It was originally planned that it be commissioned at the same time as the Kings Cross translator, serving the Manly area through to Allambie Heights, Dobroyd Point, Middle Head and Balmoral, together with the southern foreshores of the Harbour to about Elizabeth Bay. But this has been held up by environmental challenge relative to the transmitting site, and its future is uncertain.

To take advantage of the UHF translators, and also the multicultural UHF channel 28, viewers need to have a receiver capable of tuning to the UHF band. In most cases, they will also need a new, outdoor UHF antenna and appropriate feed cable to the receiver. This may involve considerable outlay.

It must be stressed, however, that the UHF transmitters/translators are there to provide alternative access to the programs carried by the existing VHF channels 0, 2, 7, 9 & 10. Those transmissions will not be affected in any way and, if they are providing an adequate signal to a viewer's home, he/she can simply forget UHF. But, if the VHF signals are poor, then UHF may provide the opportunity to receive good TV pictures — perhaps for the first time!



## Coming to grips with UHF TV — continued

merge the VHF and UHF signals adjacent to the mast with a combiner, and run a single cable down to a European style receiver, with its single coax connector. If the VHF and UHF antennas are widely separated, it may be easier to use two cables and put the combiner near the receiver.

With an early Australian receiver, the preference to do one thing or the other may have a different bias. With a Japanese receiver, at least one balun may be necessary, as well.

One point to note: the existing VHF antenna may or may not be in the best position for a UHF antenna. However, if it transpires that they can be mounted on the same mast, they should not be closer together than one wavelength in UHF terms. This would be 0.6 metre at 500MHz, 0.4 metre (approx) at 800MHz.

At the seminar, local antenna companies had mounted an imposing array of UHF antennas, hardware and supplementary gadgets, plus a wide range of masthead amplifiers, distribution amplifiers, etc. Much of it is imported at present but locally produced items will gradually take over as demand builds up.

The message that came through loud and clear is that, while UHF TV is relatively new in Australia, it is well established overseas and little actual pioneering needs to be done. The choice and installation of antenna systems need involve very little extra in the way of time and effort provided:

*How the Kings Cross (KC) and North Head (NH) translators are placed in Band V. The allocations include translators for channels 2, 7, 9, 10 and 0/28. There is allowance for three other channels shown as X, Y & Z.*

- We do not try to perpetuate the present casual approach to VHF installations, particularly that adopted by untrained roof jockeys.

- We take the trouble to discover what is good UHF practice and apply it as a matter of routine.

In the context of community installations, flats, home units, etc, a great deal depends on the nature of the existing cable and the care with which it has been installed.

In the most fortuitous situations, it may be necessary only to install a UHF antenna and booster amplifier and to feed the respective VHF and UHF signals down the existing cables.

Commonly, however, it turns out that wall outlets and cable junctions have to be repaired after long years of neglect, or up-dated, or fitted with new splitting components, and so on.

In the worst case, where the VHF distribution has been installed badly in the first instance, it may need to be replaced completely if the occupants are to enjoy a new high-grade UHF service.

Whatever course is adopted, the objective in all situations (institutions, communal or private homes) is to provide a clean signal at each outlet preferably not less than 1.5mV across 75 ohms. That should ensure a substantially noise-free picture in most, if not all, domestic receivers.

### RECEIVER PERFORMANCE

How well receivers in Australian homes will perform on UHF has yet to be discovered.

When planning the system, the P&T Department — now the Department of Communications — did detailed testing of numerous sample receivers to verify such things as sensitivity, selectivity, adjacent channel rejection, etc. However, engineers at the seminar were clearly concerned about the possible performance — or lack of it — which might be thrown up when the public try to put to use a facility which has been ignored for as many years as the sets are old!

They may discover, for example, that the funny little dial with numbers on it is too hard to tune. Or perhaps it's intermittent, or subject to drift, or given to producing only snowy pictures. Worse still, it may not work at all, because the manufacturer may not have

with adjacent channel selectivity.

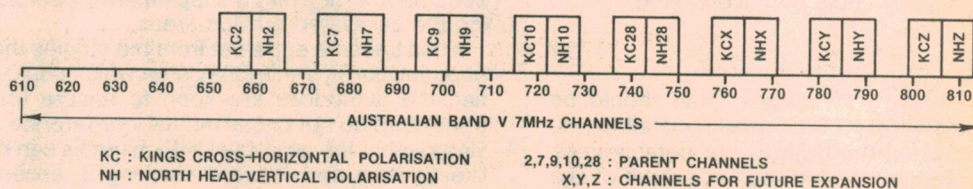
When the VHF system was planned in Australia, the authorities settled for a 7MHz bandwidth for each TV channel. This seemed a logical choice, to conserve spectrum space, and because it was adequate to accommodate a normal, compatible PAL colour picture and sound transmission. Accordingly, the need was specified for receivers to be fitted with appropriate adjacent channel traps, just in case they had to cope with two active adjacent 7MHz TV channels.

To date, that provision has never had to be put to the test, en masse, because it has been possible to avoid the situation of two television stations in any one centre operating on adjacent 7MHz segments.

However, with the need to envisage a network of supportive UHF transmitters/translators covering Sydney and its environs with up to eight programs, planners no longer have the option of leaving half the channels unused. Where necessary, translators will have to operate in adjacent channels.

More than that, because receivers for the Australian market have (or should have) traps for 7MHz channel spacing, this convention has been carried over into UHF planning. As a result, Australian usage of the Band IV/Band V portion of the spectrum will fall midway between American and European practice. In USA the channels are adjacent and 6MHz wide, in Australia 7MHz and in Europe 8MHz.

Planners have grasped the proverbial nettle with the Hyatt/North Head translators. They will operate on



installed the "biscuit" in the VHF tuner which may be necessary to accept the signal from the UHF tuner!

This could pose quite a problem if the model or the brand is no longer represented on the Australian market.

Similar frustration may face those who bought a receiver convertible to UHF, but for which the appropriate adapter or tuner is no longer available.

As with many circumstances in life, those concerned will not realise that something is missing or unusable until they actually need it!

For those receivers which do not have any provision to receive UHF stations, a possibility is a "down converter" — an add-on unit which shifts the UHF stations back down to a vacant UHF channel. Whether these will be available, and for how much, remains to be seen.

One other potential problem has to do

adjacent channels and possibly expose any latent problems there are in receivers owned by viewers in those areas where the transmissions overlap.

Planners have also moved to ease such problems by specifying vertical polarisation for the North Head translators, so that receiving antennas will strongly favour the service for which they are intended. In addition, discrimination will be increased by the normal directivity of UHF antennas.

The next 12 months is going to be an interesting period for the Department of Communications and also for Sydney Television Facilities, the joint channel 7-9-10 company that has sunk over \$1 million thus far into the venture.

As one of the departmental planners confided: "You can spend as long as you like with maps, computers and signal generators. You only know for sure, when the whole thing gets to air!"



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\$	¢	\$	¢	\$	¢	\$	¢	\$	¢	\$	¢	\$	¢	\$	¢
25B	1.15	25C	6.25	25D	9.70	TA7130P	4.60	5387AAN	9.80	TA7130P	4.60	5387AAN	9.80	TA7130P	4.60
101	1.15	799	6.25	380	9.70	7141AP	12.00	5799NBR	9.80	7141AP	12.00	5799NBR	9.80	7141AP	12.00
525C	1.15	815	0.90	388	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
529	2.10	828	0.90	389	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
534	2.20	839	0.90	390	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
536A	2.20	849	0.90	391	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
536B	2.20	859	0.90	392	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
489	2.20	869	0.90	393	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
489	2.20	879	0.90	394	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	889	0.90	395	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	899	0.90	396	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	909	0.90	397	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	919	0.90	398	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	929	0.90	399	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	939	0.90	400	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	949	0.90	401	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	959	0.90	402	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	969	0.90	403	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	979	0.90	404	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	989	0.90	405	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	999	0.90	406	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1000	0.90	407	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1010	0.90	408	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1020	0.90	409	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1030	0.90	410	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1040	0.90	411	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1050	0.90	412	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1060	0.90	413	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1070	0.90	414	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1080	0.90	415	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1090	0.90	416	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1100	0.90	417	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1110	0.90	418	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1120	0.90	419	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1130	0.90	420	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1140	0.90	421	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1150	0.90	422	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1160	0.90	423	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1170	0.90	424	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1180	0.90	425	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1190	0.90	426	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1200	0.90	427	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1210	0.90	428	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1220	0.90	429	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1230	0.90	430	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1240	0.90	431	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1250	0.90	432	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1260	0.90	433	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1270	0.90	434	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1280	0.90	435	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1290	0.90	436	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1300	0.90	437	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1310	0.90	438	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1320	0.90	439	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
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541	2.20	1340	0.90	441	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1350	0.90	442	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1360	0.90	443	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1370	0.90	444	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1380	0.90	445	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1390	0.90	446	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1400	0.90	447	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1410	0.90	448	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1420	0.90	449	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1430	0.90	450	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1440	0.90	451	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1450	0.90	452	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1460	0.90	453	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1470	0.90	454	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1480	0.90	455	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1490	0.90	456	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1500	0.90	457	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1510	0.90	458	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1520	0.90	459	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1530	0.90	460	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1540	0.90	461	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1550	0.90	462	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1560	0.90	463	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1570	0.90	464	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1580	0.90	465	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1590	0.90	466	6.30	592H	1.55	5387AAN	9.80	592H	1.55	5387AAN	9.80	592H	1.55
541	2.20	1600	0.90	467	6										

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# FORUM

Conducted by Neville Williams

## Vented loudspeaker systems — Data on drivers often not available

As we had anticipated, our article in the September issue on designing vented speaker enclosures generated considerable interest. It also underlined the fact that vital parameters have never been published for most of the drivers to date, which might otherwise be considered as possibilities for a vented system.

Unfortunately, the article helped to generate the wrong kind of interest on the part of a reader from Mt Eliza, in Victoria.

The particular issue was enclosed in a plastic bag, which also contained Tandy's catalogue for 1981. The correspondent was unhappy because he had to rely on the cover lines as a guide to what the issue contained. Presumably, one that especially caught his eye read "Designing vented speaker enclosures". I quote:

*"... This situation is made worse by the deceptive descriptions on the front cover eg 'Designing vented speaker enclosures' turns out to be a deep technical discussion outside my comprehension, not a constructional item that I could use."*

In passing, I must say that the distribution of major catalogues with "Electronics Australia", usually around April and September, is well supported by readers. This much is quite evident from the circulation figures.

However, it does present us with a logistics problem, as well as involving extra cost. We also have to keep in mind postal requirements involving the many issues which are mailed direct to subscribers. In summary, our options are as follows:

**Loosely inserted:** this tends to be a slow and costly labour-intensive operation. Subsequent bulk handling is awkward, because the catalogues tend to fall out. Newsagents don't like them for the same reason.

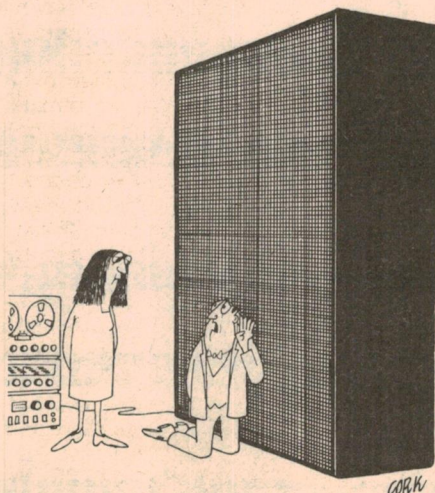
**Stapled into the book:** fine, except for one recurring problem. Normal printery saddle stitching machines can't adequately cope with a near 300-page combination.

**Square finish, bound in:** we tried this in November '77 and it produced a very neat book. But readers didn't like it because they could not separate the two components.

**Plastic envelope:** the most practical scheme at present. It keeps the two items together and in good condition, and imposes the fewest restrictions on each in terms of trim, size and binding. But, logically, we have to indicate on our cover what is inside.

Which brings me to the allegation that the cover lines on the September issue were deceptive — a statement that implies deliberate dishonesty on our part.

Looking again at those lines, I am at a loss to know how one could possibly be more matter-of-fact, and that includes the line "Designing vented speaker enclosures".



*"Of course it's right. It's based on the work of Thiele and Large!"*

That is precisely what the article is about. If we had said "Building ..." or "Constructing vented speaker enclosures", it would indeed have been open to misinterpretation; but we clearly said: "Designing ...".

In fact, we negotiated reprint rights of the article because we felt that the Author, David Weems, had done a good job in summarising and communicating the investigative work of Neville Thiele and Dick Small into vented systems.

But there was no way that David Weems could have reduced the design procedures to the over-simplified approaches of other days, and it is understandable that our correspondent from Mt Eliza still found it more than he could cope with.

As Weems points out in the article, those early simplistic approaches totally ignored certain vital parameters and led to the vented system being thoroughly discredited.

As far as he — and we — were concerned, the article would serve a useful purpose, if it merely helped to set the record straight.

In fact, it did much better than that, as evidenced by a number of other letters to hand. All agreed that it shed much needed light on the subject but all went on to ask a variety of questions, indicating their desire to follow through on their own account.

A common complaint had to do with the almost complete lack of the driver data necessary to implement the Thiele/Small/Weems information. We heartily agree but we do know that data appears in the new Magnavox catalogue, covering their present range. This catalogue is available free from Magnavox (Aust) Pty Ltd at 6 O'Riordan St, Alexandria, NSW 2015. It is likely that they would also be able to supply relevant information about some of their more recent, but now obsolescent bass drivers.

Etone do not have the information in such accessible form but, for clients who want to design a vented system around one of their drivers, they should be able to make the information available. Etone



Pty Ltd are at 53 Stanley St, Peakhurst, NSW 2210.

As for JBL drivers, mentioned in Weem's article, the brand is handled in this country by Harman Australia Pty Ltd, at Unit 13A-2, 6-8 Byfield St, North Ryde, NSW 2113. Phone (02) 887 3233. Thiele/Small parameters are readily available.

I very much doubt that the information would even exist for the once well known products of Rola and MSP, or for a whole range of other well known but now obsolete drivers.

As for current model imports, or current models from other local manufacturers/assemblers, each would have to answer for themselves.

On correspondent questioned the accuracy of such data, even when obtained, on the basis that not all manufacturers would be able to hold their drivers to tight specifications.

I talked this over with a loudspeaker engineer who agreed that the problem was real, in terms of mathematical nicety. However, he went on to point out that an enclosure design based on published parameters would at least "be in the ball park" and capable of intelligent physical modification if there was the means and the will to do so.

It would be way ahead of something contrived without any guidelines.

A couple of correspondents asked about methods of checking or even determining parameters by measuring the behaviour, near resonance, of any given driver; this in an un-mounted situation.

There are ways in which this can be done and I understand that the matter was covered in the original Thiele/Small literature. I have never attempted it in practice but I gather that very precise procedures and measurements are required if meaningful results are to be obtained.

## ORIGINAL PAPERS

Various other questions emerge from the letters, mainly prompted by David Weems' summary and indicating a desire, on the part of the correspondents, to follow the matter right through. For example, where can I get a complete set of references relating to the Thiele/Small papers?

Fortunately, the Institution of Radio and Electronics Engineers, Australia, which published much of the original work, has now moved to meet these requests. In consultation with the two authors, the Institution is currently preparing to reprint their key papers on vented systems in a single booklet.

It might seem from all this that vented systems are still something of a lottery, but such is not the case.

Major equipment manufacturers have long since committed the procedures to computer programs, which have proved highly functional. Feed in the bottom-end specification you want to meet and,

provided it is practical at all, the computer will print out the kind of driver that will be needed and details of the enclosure in which it must be installed.

Lacking such a computer program and a captive loudspeaker factory, academically trained enthusiasts can still arrive at a satisfactory end result by resort to the Thiele/Small literature.

Without academic training, the individual becomes more dependant on yet rather sparse data from individual manufacturers, even to plans for enclosures which have hopefully been the subject of rigid design procedures.

But, at least, the hifi industry is headed in the right direction, in relation to vented systems, rather than merely fiddling with drivers and with boxes with holes in them!

## ELECTRICAL HASH

To change the subject, we talked a good deal about electrical interference in the October issue, with special reference to domestic light dimmers. It prompted a few comments but did not raise a whirlwind.

The most common observation was along the lines: "yes, domestic light dimmers do cause a bit of hash in the radio but..." (Let's talk about something that really matters!)

And that's the way it seems to be with so many environmental issues. If you can manage to ignore something, for the present, then it doesn't exist!

As for light dimmers — if they don't wipe out the stations you want to listen to, forget them.

I was encouraged, however, to receive a call from a manufacturer of domestic light dimmers, who told me that they were taking a closer look at their product. It already includes some RF hash suppression but they are hoping to carry it further. The problem they face is to cram the extra filtering into the existing dimensions, so that the fitting can still replace an architrave switch.

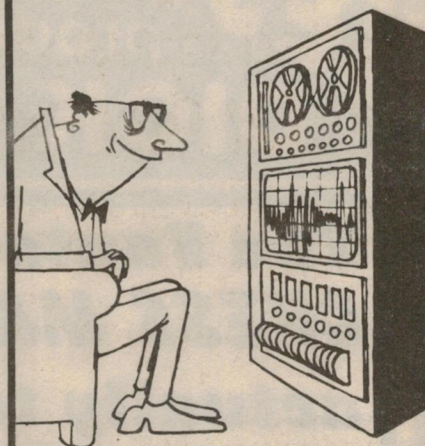
And, of course, they have to keep the cost down to a competitive level. Hopefully, I will be able to report a positive outcome.

R. C. of Benalla, Victoria, passes over the light dimmer situation, to remark about the interference: he has encountered from motor speed controllers, notably those used in connection with air conditioning fans. In many cases they are supposed to have RF suppression fitted but they still leave a lot to be desired.

He cites the case of a house, which he purchased, where the controller virtually blacked out radio reception over a radius of about 30 metres. By installing additional filtering, he was able to shrink the interference zone to less than one metre.

While on the subject of RF interference, it is interesting to note that channel 0 television has just come on air in Sydney, for the first time, carrying the

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new multi-cultural service. Granted that Sydney viewers do not have optimal antennas for the channel, and granted that the power level and siting is down somewhat on the other stations, but it is already evident that the 45-52MHz channel is more prone to mains interference than other channels higher up in the spectrum.

Also of interest was a letter from a reader in Qld. He has taken up my observation that aluminium foil under the roofing tiles may tend to shut out radio signals and shut in RF interference — leading to poor radio reception in the house. I quote:

*Let me tell you of the problem I ran into when I moved into a typical Queensland wooden house on stilts. However, this one had been covered with aluminium siding, plus Peralum placed over the old galvanised roof.*

*I found myself in a partially shielded metal box. It did not have too much effect on radios with ferrite rods but, with my two tuners requiring ordinary wire antennas, it caused all sorts of trouble.*

*There must be many others who run into similar problems. For example, I think of the lady who complained to me recently that her radio was terrible, now that she had moved into a home unit. It has been perfectly satisfactory in the house where she lived previously. All I could suggest was that she move the radio to some location near a window, in the hope of getting a better signal.*

*H.S. (Bulimba, Qld)*

The correspondent goes on to suggest a couple of ways around the problem.

He recalls, for example, the one-time "Captain" aerial unit which was supposed to have rather magical signal pickup qualities. If it is the gadget I remember, I would not expect it to be of any assistance at all in apparently shielded situations.

His second suggestion is more promising: provide a normal ferrite rod antenna external to the receiver, tuned by any ordinary 400pF (approx) variable capacitor. Wind a few turns of hook-up wire around one end and use it to transfer the signal to the antenna and earth terminals of the radio. The rod antenna would need to be retuned to each desired station but it should provide a good signal. Thank you, H.S.

A more convenient option may be to use a single turn loop antenna — the larger the better.

In its simplest form, it comprises a length of hook-up wire which starts at the receiver's antenna terminal, runs up to a convenient support point, then horizontally to another support; then vertically downwards, horizontally back towards the receiver, and finally up the receiver earth terminal, thus forming a complete loop in the vertical plane.

It may typically be fastened to the back of a furniture module, to the rear of shelves, or fastened to the wall and disguised by the picture rail, skirting board, etc. Or it can be run above the ceiling and below the floor; even on an exterior wall.

The one thing to remember is that a loop has minimum signal pickup broadside on. Therefore, as far as possible, orientate it so that it is edge-on to the general direction of the desired stations.

## Ian Pogson to retire

Well known staff member Ian Pogson has decided to retire and will be leaving us on the 12th of this month. We wish him well during his retirement and trust that he will be able to catch up on the many interests which tend to be set aside when one has an everyday work commitment.

Ian Pogson joined our staff in April 1962 with the special task of looking after a then relatively new venture by our parent company — news gathering by way of radio-equipped cars and picture vans. Subsequently he transferred to our magazine staff, producing the many projects and articles which carry his name.

In 1963, Ian resigned to take a position with EMI but, within two years, had rejoined our magazine staff. He has always had a special interest in communications, and in time and frequency measurement, as will have been evident from his articles.



Of special note were his designs for the "Deltahet" series of communications receivers which, almost certainly, represented a world first in the do-it-yourself application of the Wadley Loop principle. They may well have been a first, in any context, outside the RACAL group.

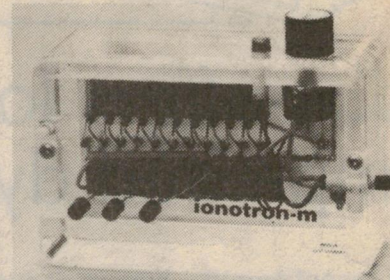
Privately, Ian has a strong interest in audio and in electronic organs, his latest venture being the construction of a Wersi "Zenith" model for his own home. There are no prizes for guessing how some of his leisure time will be spent!

All the best, Ian, and thanks for your assistance over many years.

Neville Williams

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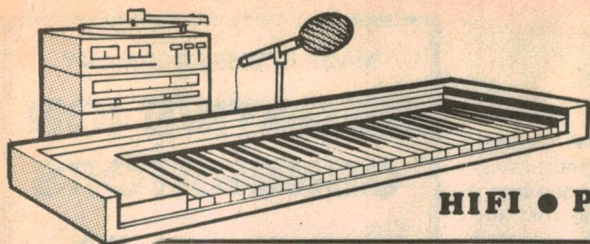
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# AUDIO ~ VIDEO ELECTRONICS

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## dbx offers lower noise and improved dynamic range

In recent months, buyers of audiophile recordings may have noticed references to "dbx", alongside other topical terms like "direct cut" and "digital master". This article, based on information supplied by TEAC Australia Pty Ltd, explains what dbx is all about.

The subject was further brought to our attention by receipt of an Audiolab recording, reviewed elsewhere in this issue, which had been transferred from a dbx encoded master tape. We were impressed both by the minimal background noise and by the lack of constriction of the high amplitude transients.

The same company which supplied this disc — M. R. Acoustics of Annerley, Qld — also list a number of other discs which carry a dbx-encoded signal. They must be played back through a dbx decoder, for normal dynamic range.

In fact, the present strong emphasis on reduced noise and wider dynamic range appears to be focusing attention on dbx

in various roles, as a means of achieving these ends with otherwise normal analog equipment.

While dbx is broadly classified as a noise reducing system, it is more radical in its operation than any of the other methods: Dolby, Adres, Hicom, etc.

Dolby and other such systems selectively process a portion of the signal which lies above or below a certain reference level, and/or within a certain range of frequencies.

Dbx, on the other hand, processes the whole of the signal the whole of the time. During the encoding process, the entire dynamic range is compressed in decibel terms by a factor of 2:1.

When decoded for final reproduction, the signal is expanded by the same ratio, restoring the dynamic range to normal. The inspiration behind the term "dbx" is not hard to discern — "db expansion". The full registered name of the system is more of a mouthful: "The Decilinear Noise Reduction System".

Explaining the relevance of dbx to sound recording and reproduction, the TEAC literature points out that the dynamic range of orchestral or rock music may easily run to 80dB; perhaps even to 90 or 100dB in exceptional cases.

Against this, the effective dynamic limits of a modern tape system begin to nudge the noise and saturation regions after 60dB, and seldom achieve better than 70dB.

If the recording engineer does indeed have available 70dB of dynamic range, and the signal from the studio console can be fitted exactly to it, then a top quality recording should result. But there is no latitude for error and even a slight miscalculation is sufficient to drop the quiet passages into the noise floor or to begin crushing the peaks.

Since the noise is the more obvious liability, there is a strong tendency to play it safe the other way, if need be at the expense of signal peaks.

The insidious thing is that peak crushing in a tape system does not necessarily produce blatantly obvious distortion. The overload is often both "soft" and subtle: the loss of ultimate "bite" in a sudden transient; a loss of

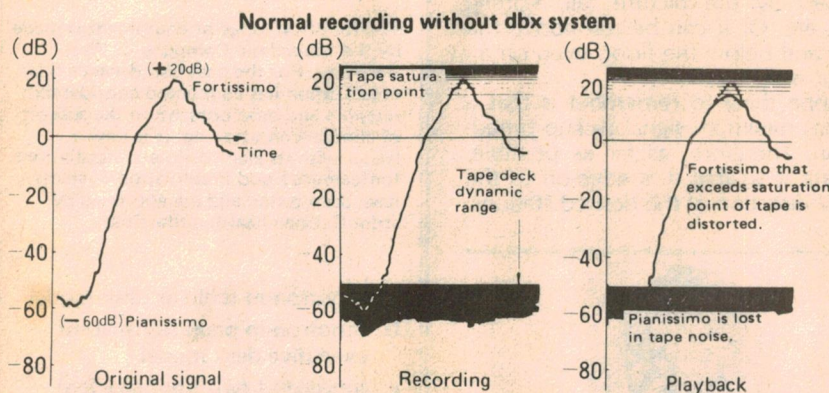


Fig. 1: Signals of wide dynamic range (left) tend to exceed the dynamic limits of a tape system (centre) resulting in loss of quality on playback (right).

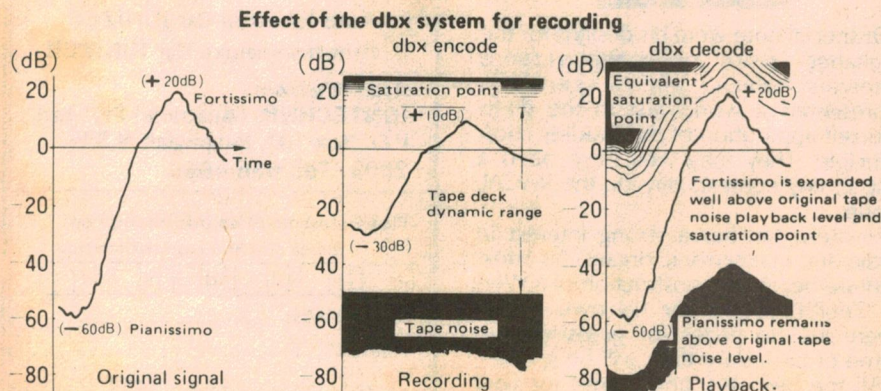


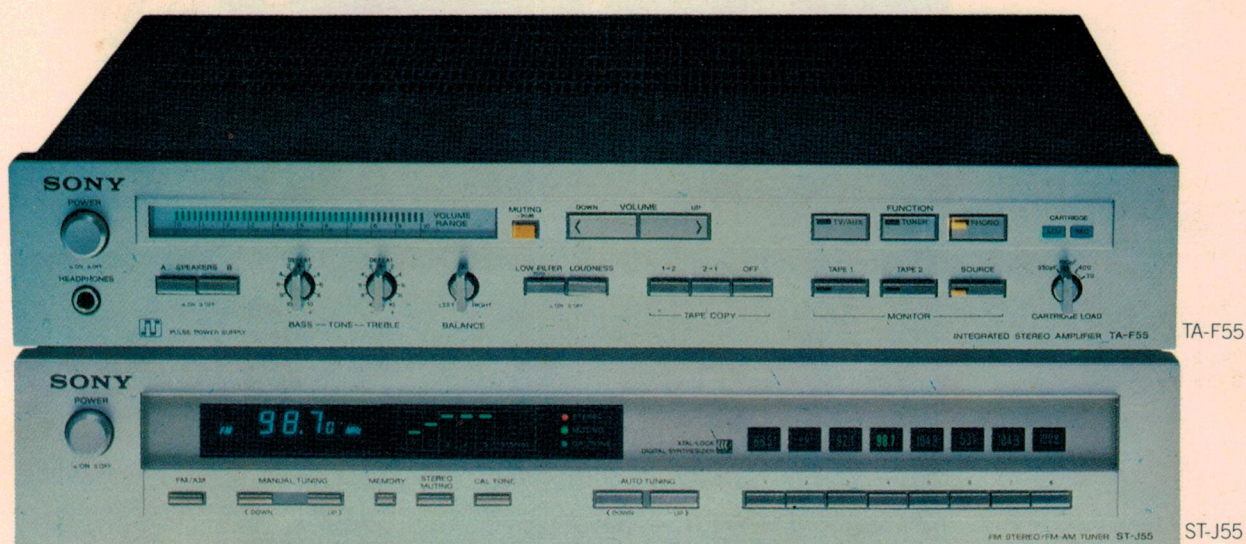
Fig. 2: with dbx, the original signal (left) is dynamically compressed to half (centre), well within the system limits. The playback signal (right) is not crushed.



# Sony's inseparable separates.

Sony's new ST-J55 tuner and TA-F55 amplifier come in elegant matching designs. Separately, they're

straight signal processing circuit construction, revolutionary Heat Pipe, and Pulse Power Supply, providing



outstanding. Together, they're out on their own, both in appearance and performance.

The J-55's tuner is frequency synthesized and quartz locked. A neat line of feather-touch switches gives a choice of Memory, Auto, or manual tuning.

The J55's incredible electronic MNOS memory tuning lets you preset your 8 favourite AM/FM stations – including reception adjustments like muting or mode pre-set.

The other half of the team, the 65W F55 Amplifier, features an electronic motor driven volume control,

extremely clean and noise-free sound quality.

The F55 operates with almost any type of MC and MM cartridge; has gold-plated phono jacks, oxygen-free copper wiring, metallized film resistors and polypropylene capacitors.

You won't find better engineering than these. Not even from Sony.

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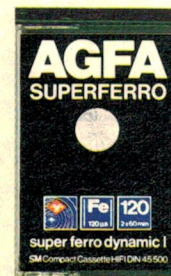
Agfa SUPERFERRO—the sound safe—will record and store your music safe in sound, ready for when you want it. And we mean all the music. The outstanding performance of Agfa SUPERFERRO is achieved through the use of a particular form of ferric oxide particle that is uniform in shape and size. The second factor is an Agfa technique that enables more particles to be deposited per sq. mm of tape, with each particle separated and in line to eliminate cross-over interference.

The advanced technology of the SUPERFERRO tape results in five big improvements:

1. Reduced background noise.
2. Better maximum output level.
3. Improved dynamic range.
4. Improved high frequency output level.

5. Reduced harmonic distortion. In addition, Agfa SUPERFERRO cassettes feature a special mechanism for improved running properties.

Agfa SUPERFERRO—the sound safe you can bank on for outstanding performance.



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definition in loud, complex passages. Music critics refer to it as a lack of "air" around the instruments!

What all this can add up to, in terms of the end result, is indicated, clearly enough, by the current crop of discs cut from digitally-encoded masters. Not only is noise not a problem but there is a certain freedom — a lack of constriction — about the transient peaks and the louder passages generally.

It is difficult to escape the conviction that it is due simply to the 90dB dynamic range of the digital mastering systems; that transient crushing has been more commonplace in master tape recorders than has been fully realised.

The dbx approach to the problem of dynamic range is just the reverse to that of the digital equipment. Instead of widening the dynamic aperture of the equipment to accommodate the music, it compresses the music to fit the limitations of the recorder.

## How dbx works

Fig. 1 from the TEAC literature illustrates the problem which faces anyone who seeks to record a musical event on tape. Plotted against time on an arbitrary decibel scale, the peak sound pressure level may vary from -60dB in the softest passages to +20dB at the other extreme.

But the 80dB of dynamic range so represented exceeds that of the tape system, with the result that the softest passages have to compete with the system noise, while the loudest passages are subject to crushing in the manner already described.

However, if the raw signal is passed through a dbx encoder, en route to the tape recorder, the 80dB dynamic range is compressed to 40dB (-30dB to +10dB), which fits easily inside the dynamic window of the tape system. (Fig. 2)

On playback, the compressed signal is decoded en route to the amplifier, and the dynamic range reverts to 80dB. The soft passages are attenuated from -30dB to -60dB and the noise floor of the tape is pushed down towards an apparent 80dB or more. Similarly, the +10dB peaks are expanded to -20dB, with the apparent saturation level of the tape somewhere above that again.

Fig. 3 illustrates the operation of the system in bar graph form.

In earlier days, such radical processing of the signal could hardly have been considered seriously. Not only would the electronics have been dauntingly complex but the distortion content could also have been prohibitive.

Solid-state circuitry has changed all that, with the result that TEAC are now offering a cassette deck with dbx in-built, plus a number of modestly proportioned dbx processors for use with existing equipment. They claim that the dbx encode/decode process does not add perceptibly to the distortion level in-

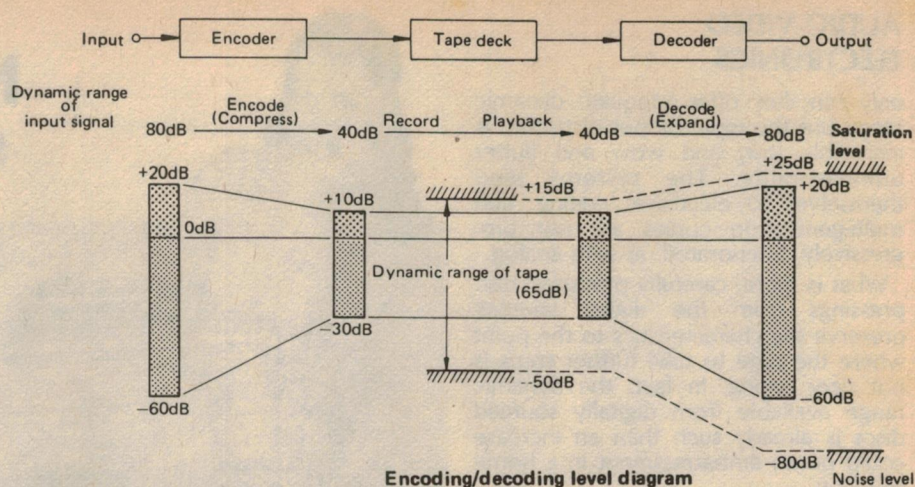
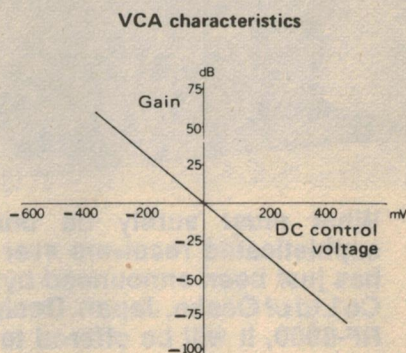


Fig. 3, top: From the TEAC literature, this diagram illustrates the operation of the dbx system in bar graph form.

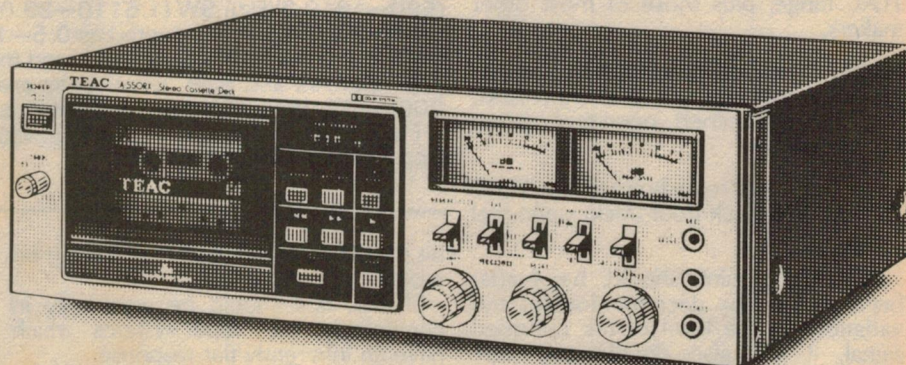
Fig. 4, left: Illustrating the relationship between the gain of the voltage controlled amplifier and control voltage.



signal by an equivalent amount. Proponents of the dbx system stress that, unlike most other systems, it does not depend on precise control of levels for proper "tracking" between the encode and decode functions. It is a simple 2:1 transformation in both modes.

In detail, the dbx circuitry also involves some internal pre-emphasis and de-emphasis during encode and decode respectively but this is again complementary and independent of signal content or levels. It tends to further reduce noise and distortion from the tape medium and to help minimise "breathing" sounds which might result from operation of the control circuitry itself.

However, while dbx has the potential to boost the performance of analog mastering equipment in terms of dynamic range, it is hard to see how it can compete in longer term with the new digital mastering systems, such as from Soundstream, Sony and others. Not



The TEAC A-550RX is a high quality deck with excellent basic specifications but with two noise reduction systems in-built: Dolby and dbx. The latter system is available as an optional extra with other cassette decks in the TEAC range.



## AUDIO-VIDEO ELECTRONICS

only can they offer adequate dynamic range but the input/output distortion is incredibly low, and wow and flutter unmeasurable. The systems lend themselves to electronic editing, and multi-generation copies are not progressively deteriorated, as with analog.

What is more, carefully produced disc pressings from the digital sources preserve the characteristics to the point where the urge to take further steps is not very strong. In fact, the dynamic range available from digitally sourced discs is already such that an increase could be an embarrassment in a home situation.

On this basis, the market for dbx-encoded discs would also seem to be rather limited.

However, irrespective of what transpires in these areas, it was evident from discussion with TEAC Australia that dbx has a continuing role for small studios and semi-professional situations. Because of developments in high-budget areas, expectations are higher but there is no way, at present, that many low budget users could re-equip with digital.

In particular, TEAC see dbx as a natural ancillary to their TASCAM series of portable and small studio equipment.

Another role is in the home, where enthusiasts may wish to make a cassette copy of new digital discs. Unaided, cassette decks will be hard put to it to do them justice. Again dbx could be the answer.

In fact, as already mentioned, TEAC's A-550RX cassette deck has in-built dbx, such that it should be able to cope directly with the most ambitious digital and direct-cut recordings.

In addition, by copying a dbx encoded disc directly, and then replaying with the dbx decode function operative, normal dynamic range is recovered.

Other items listed in the TEAC dbx range include:

**RX-8:** dbx noise reduction unit designed originally for TEAC C-series cassette decks. In fact, we understand that it adapts readily to other decks in the TEAC range, plus those of most other makers.

**DX-2A, DX-2B:** dbx noise reduction units intended primarily for use with TEAC (and possibly other) open-reel stereo decks.

**RX-9:** dbx noise reduction unit for TEAC A-3440 multitrack (four-track) open-reel deck.

One final point should be made: because the dbx decoder doubles the variations in the level of the recorded signal, it will also double any non-linearity in the frequency response of the tape recorder. Thus, a 3dB peak or trough imposed by the recorder/tape combination on the encoded signal will



## National's new super receiver

*Styled like a portable receiver, the RF-9000 can be carried — but hopefully not too far! It can operate from internal batteries (12 x UM1 "D") or from external 12V-18V DC or from power mains at 110V or 240V AC, 50/60Hz. It is rated to deliver a maximum of 7 watts to its in-built dual speaker system.*

**What must surely be one of the most expensive and sophisticated receivers ever offered on the consumer market has just been announced by the Matsushita Electric Industrial Co Ltd of Osaka, Japan. Designated as the National/Panasonic RF-9000, it will be offered to US consumers at about \$3,800.**

As you might expect, the RF-9000 is no ordinary receiver. It incorporates a phase-locked loop which can hold the tuning rock steady at frequency intervals of 100Hz — giving it the theoretical potential of locking to about 300,000 distinct channels. The relevant frequency is displayed in digital form at the top centre of the control panel.

The receiver incorporates a microcomputer control system, so that the user has merely to key into the liquid crystal display the wanted frequency — using push-buttons in the manner of a calculator. The receiver moves to the nominated frequency and the phase-locked loop holds it spot on, without further attention.

For more direct access, the receiver can be memory programmed for up to 15 broadcast stations. It can then be pushbutton tuned to any one, or will automatically scan them at 1.5sec intervals to allow the user to freeze it on the sound he wants. The set can also be switched directly to any of 22 bands by simply pushing the appropriate button. In the event of the user preferring old-fashioned manual tuning, that is available too, by way of a large knob at the lower right.

Nor need there ever be any doubt about the time, when a special session is coming up. A quartz digital clock, tied back to an internal 3V clock/memory sustain battery, can display month/date/day or hour/minute/second, as required. It is inter-linked with the microcomputer and can turn on up to six wanted programs on a daily, weekly, cyclic, or a one-time basis. It has a dual-time facility, time signal provision, and a sleep timer.

Coverage of the RF-9000 includes LW (150—420kHz), MW (520—1610.9kHz), SW (1.6110—29.009 MHz) and FM (87.5—108MHz). Sensitivity on short-wave is quoted as 0.5—1.0uV, image ratio as 70dB and 100dB at the two intermediate frequencies, and there are three steps of selectivity to cope best with AM and SSB. Dimensions are quoted as 520mm(W), 362mm(H) and 206mm(D). Weight, without batteries, is 20.3kg.

For further information: P. Binning, National Panasonic (Australia) Pty Ltd, 95-99 Epping Rd, North Ryde 2113.

be magnified to a 6dB peak or trough on replay.

Clearly, dbx should be used only in conjunction with tape systems which have an inherently flat response.

For further information on TEAC/dbx equipment, contact TEAC Australia Pty Ltd, 165 Gladstone St, South Melbourne 3205. Phone (03) 699 6000.

## IN BRIEF . . .

**PIONEER** have added the KE-4000 AM/FM-stereo cassette radio to their current automotive range. The radio has an electronic memory which can store 10FM and 5AM station frequencies, allowing them to be recalled instantly



# The new generation of factory-built or kit-set Peerless loudspeakers



It's true most speakers *look* alike and that price alone never tells the whole story. But now the new generation Danish-built Peerless loudspeakers give you a recognizable difference in sound quality—a difference that has set Peerless a notch above the others for over 50 years.

The range of new generation Peerless loudspeakers includes the fully assembled *PAS series* plus the money-saving *PLK kit-sets*. Both series contain drive units with the following characteristics.

## Peerless 'X' Line Woofers

- ☐ Large ceramic ferrite magnets for high power handling.
- ☐ Specially coated cones reduce colouration to a minimum.
- ☐ Cones are supported by a single-roll foam or rubber surround to maintain excellent linear motion. ☐ Bass response is clean and tight at all listening levels.

## Peerless Midrange Units

- ☐ Sealed back units prevent interaction with the woofer. Distortion and colouration are reduced to a minimum. ☐ The rear side of the cone is coated with a special damping material to eliminate colouration. ☐ Specially impregnated polyurethane cone rim provides high degree of linearity.

## Peerless Tweeters

- ☐ Dome tweeters designed for the highest accuracy of reproduction with low distortion flat response and wide dispersion. ☐ The sealed back isolates the tweeter from interference. ☐ Specially developed dome fabric ensures no degradation of performance even after prolonged heavy loading. ☐ Assembly mounted on a precision diecast plate where rigidity ensures permanent alignment.

## Peerless Dividing Networks

- ☐ Peerless crossovers use air-cored chokes for maximum power handling, and special electrolytic capacitors to ensure long term reliability. ☐ All components are mounted on fibreglass printed circuit boards for maximum durability, while coded clip connectors eliminate the need for soldering.

## Power handling

The power handling capacity is high and conservatively rated at 100W RMS, however, due to the high efficiency of Peerless speakers, the recommended amplifier power is between 25-100W RMS.

Whether you settle for the smart timber-veneered *PAS* assembled series or the *PLK* kit-set, you're getting the same Danish-made Peerless quality—a quality selected by many of the world's most reputable names in loudspeakers, for inclusion in their own speaker systems.

Contact us now, and discover where you can hear Peerless loudspeakers—then let your ears make up your mind.

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## The Philips/Sony compact disc —

In a joint statement, Philips of the Netherlands, and the Sony Corporation of Japan have announced that co-operative development has led to further development of the optical compact digital disc system announced by Philips in March, 1979. The improvements relate particularly to modulation of the laser beam and to the effectiveness of the error correction system, which can be an integral feature of a digital pulse system of recording and reproduction.

The 16-bit digital system not only offers an order of fidelity way ahead of the analog system but it is possible also to encode text and program data for possible visual display by the playing deck. The disc is 12cm in diameter and carries up to 60 minutes of program material on one side.

The worldwide Polygram group has announced their intention to release music programs in the format, and the CBS/Sony group in Japan have similar plans. In the meantime, the system is being submitted to the Digital Audio Disc Standardisation Conference in Japan (at present involving 45 member companies) with a view to promoting worldwide acceptance of specifications.

However, Mr C. Bossers, Managing Director of Philips in Australia, says that release of the optical digital compact disc system was not expected in Australia until the mid-'80s.

and automatically without the need for subsequent fine tuning. Pulse noise suppression is fitted and means to switch from stereo to mono mode, where appropriate. The cassette section features auto reverse and means to take up tape slack, thus minimising the risk of malfunction. Power output is 4.5 watts per channel (continuous) and the recommended retail price \$419. Details from Robin MacDonald, Pioneer Electronics Australia Pty Ltd, 178-184 Boundary Rd, Braeside, Vic 3195. Phone (03) 90 9011.

**MAGNAVOX AUST PTY LTD** have just released a 20-page brochure which contains details of their current range of loudspeakers, suitable for use in hifi systems. In all, 17 models are illustrated, ranging from dome and cone tweeters to nominal 160mm, 200mm, 260mm and 310mm drivers, variously suitable for use as woofers, or in woofer/mid-range, or full-range applications. Each driver is clearly shown in a photograph and described in the text. Diagrams show its nominal frequency response, and dimensions from front and side. A most welcome feature is a full listing of ratings and specifications, including the data necessary to design

enclosures by the Thiele/Small method. Anyone interested in examining the potential of the new Magnavox range can obtain a copy of the brochure by simply writing to Magnavox Australia Pty Ltd, 6-12 O'Riordan St, Alexandria, NSW 2015.

**PIONEER ELECTRONICS AUST PTY LTD** announce two new appointments to their marketing planning division. Mr A. J. (Tony) Wood takes up the position of General Manager, Marketing, while Mr Robin MacDonald has become Publicity and Promotions officer. Both men join Pioneer from activities outside the electronics field but, according to Managing Director Les Black, the appointments represent a deliberate move to infuse new impetus and creativity into the electronics marketing scene.

## VIDEO BRIEFS

**TECHNICOLOUR**, pioneers in the colour film business, are making a strong play for the home video movie field. They have reportedly carried on with development started by Akai and continued by Funai, and are poised to market a lightweight video recorder measuring about 25 x 25 x 8cm. It accepts a cassette

## Sanyo portable has many facilities

Portable cassette radios are no longer the basic devices that they once were. This model M9975K from Sanyo can accommodate normal, Cr02 and metal tape and incorporates a 7-track automatic music select system (AMSS). It has a mic jack for singalong dubbing and "one touch" recording. Other features include LED VU meters, tuning indicator, auto stop, tape counter and soft eject door. It can operate from mains or batteries and offers up to 15W total power output. RRP is \$299. [Information: R. Hopwood, Sanyo Aust Pty Ltd, 225 Miller St, North Sydney. Tel (02) 436 1122.]

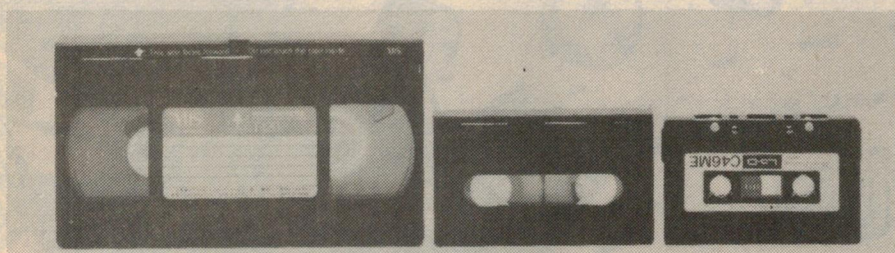
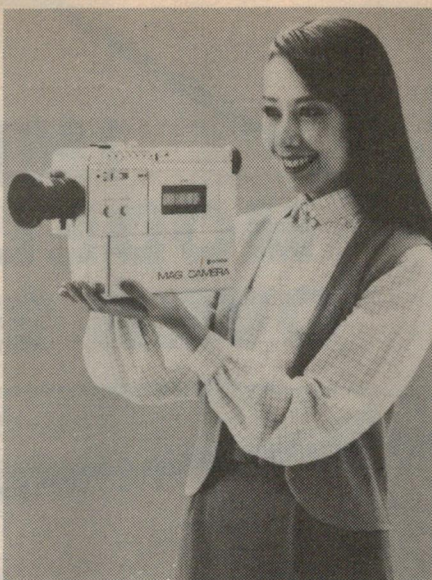




# Self-contained TV camera/recorder from Hitachi

Hitachi Ltd has recently developed an experimental colour/sound video camera and VTR combination, tentatively called the "Mag Camera". Hitachi's aim is to match the convenience and handling of an 8mm sound film camera without, of course, the need for processing and with much longer recording time. Weight of the experimental camera, including batteries, is 2.6kg.

It uses a cassette loaded with 6.4mm tape (centre) which is much smaller than the VHS cassette (left) and not much larger than a compact audio



cassette (right). A dramatic increase in helical scan recording density has yielded a two-hour playing time, with high quality FM sound: a response to 18kHz and a S/N ratio of 50dB. Image pickup by a solid-state 17mm MOS chip yields a resolution of 240 lines. The camera

can play back into a normal NTSC monitor.

Hitachi stress that the Mag camera is developmental only, at this stage, but they hope that it will help set an industry standard for portable self-contained video cameras.

## VIDEO BRIEFS — continued

only slightly larger than the present compact type and loaded with 6.3mm tape. Playing time is about 30 minutes. When teamed with a new colour camera, also being readied by Technicolour, it should prove an attractive combination for video movie buffs. (See also news release and picture from Hitachi.)

**SEARS ROEBUCK** are optimistic that they will be offering the RCA capacitance style video disc player, plus discs, by the end of '81. They will be just another mail order item. Sears R will not talk prices but the industry tip is that they will be able to hold to the RCA prediction of "under \$500".

**TV X-RAYS** are again in the news, with the proliferation of large-screen home television systems. The reasoning is that high intensity projection type tubes, with their boosted EHT requirements, must emit more X-rays than conventional direct viewing tubes. All manufacturers agree that just the reverse is the case, because of the geometry of the system. What little X-ray is radiated is directed at

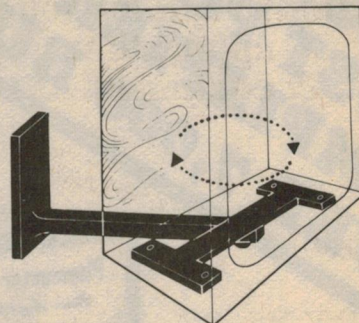
the screen and is absorbed in that general area. Viewers are alongside or behind the projector, seeing only a reflected light image.

**VIDEO DISCS** seem at the moment to be settling so solidly into three distinct standards that some major companies are taking each-way bets. Sanyo and Sharp, for example, are both reported to have signed agreements with RCA and with Philips, on the assumption that RCA will dominate the American market and Philips, the European scene. But Matsushita/JVCs VHD system, combining the simplicity of RCA's capacitance pickup with the versatility of Philips' electronic tracking plus stereo sound, cannot be ignored either. Their system too, may feature in the Sanyo and Sharp inventories.

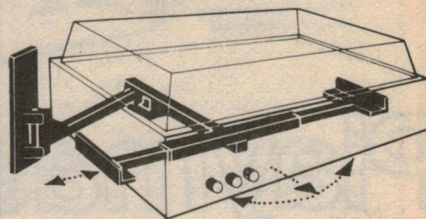
**TOSHIBA'S LVR** system is still in the works, scheduled for late 1981. It uses an endless tape loop and a single (almost) stationary head. Each pass lasts 25 seconds and enough tracks can be laid side by side along the tape to give a playing time of about two hours.

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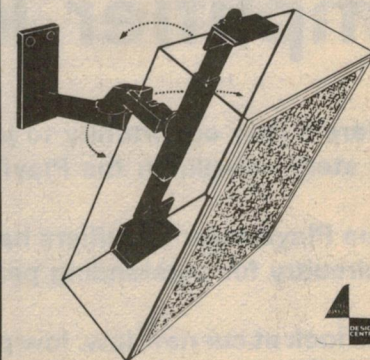
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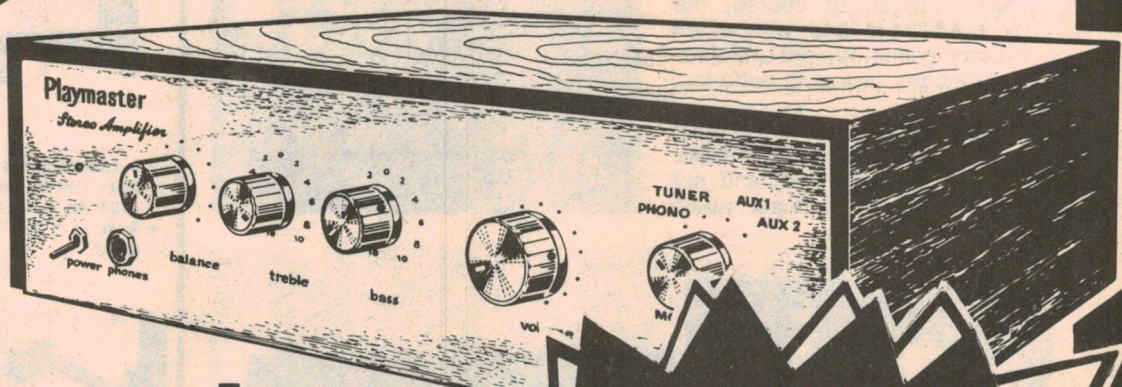
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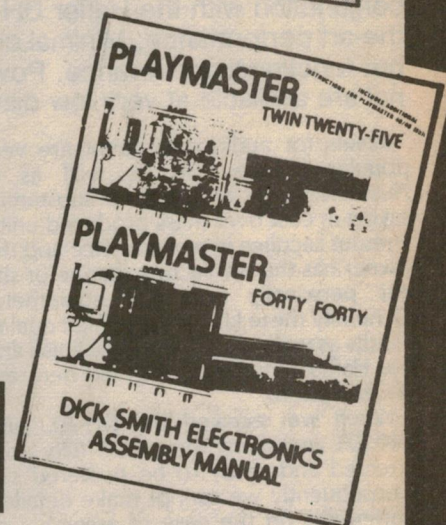
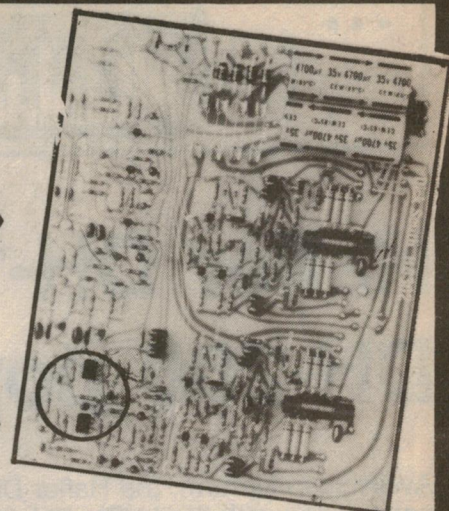
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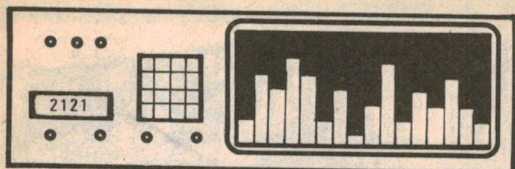
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# HIFI REVIEW

## Hafler DH-101 preamplifier and DH-200 power amplifier

Available in kit form, the Hafler DH-200 MOSFET power amplifier in conjunction with the Hafler DH-101 preamplifier, produces state-of-the-art performance. Minimal controls and a plain finish gives a basic but functional appearance. Power outputs of up to 100W per channel are available at very low distortion.

Kits for audio equipment are very popular in the USA as well as in Australia. They represent a substantial saving in cost over mass produced units, without sacrifice in performance and the owner has the satisfaction that he or she has personally built the equipment. Generally these kits will give high quality results as well as a professional finish and the Hafler amplifiers reviewed here are no exception.

When we received the DH-200 and DH-101 amplifiers, they were fully constructed and ready to be powered on. Consequently we cannot make detailed comments on the ease of assembly of these kits. Construction is simplified with the printed circuit boards, which are supplied fully operational leaving only the wiring and hardware to be done. Step-by-step instructions with the aid of diagrams are given and inexperienced constructors should have little difficulty in building the kit, provided they can solder.

Overall dimensions of the DH-101 preamplifier is 348 x 88 x 228mm (W x H x D) and the DH-200 power amplifier, 405 x 135 x 228mm. Mass of the preamplifier is a light 3.6kg but that of the power amplifier is a massive 12kg.

The appearance of the preamplifier is plain with aluminium knobs against a black-anodised front panel which supports a minimum of controls. Similarly, the power amplifier has a matching flat black finish with very large black-anodised finned heat sinks on each side of the amplifier case. The functional controls and styling of the preamplifier comes as a change from the often complicated appearance of many other modern amplifiers.

Controls found on the preamplifier are a dual concentric volume/balance knob, separate bass and treble controls and two rows of self-indicating push buttons for input selection, mono/stereo, dub, tone control defeat

and power. Indicators for the push button switches are mechanical flags located within the switches themselves — a neat feature.

Inputs to the preamplifier can be any stereo pair of the two phonos, two tape, tuner or auxilliary sources. An added feature is the external patch, such that an

operating one of these switches.

We also noticed that switching the amplifier on or off gave a fairly loud "crack" from the loudspeakers which could probably be avoided by an appropriate selection of suppression capacitor across the mains switch.

At the rear of the preamplifier is the usual array of RCA sockets, which incidentally are not quite to standard size. We found it necessary to close up the earth connections of the plugs so that this earth made contact with the socket earth. Also at the rear are two switched and two unswitched two-pin mains



equaliser or noise-reducing unit can be connected in the loop. Switching is available for duplicating from one tape to another with the DUB facility. Tape monitoring is available for both tape inputs.

Operation of the rotary controls proved to be smooth and progressive although the volume and balance control knobs were slightly eccentric — a factor which may be visually irritating although it does not affect the electrical operation. Similarly, while the push-button mode and selector switches were electrically quiet in action, they required considerable pressure to operate, with the result that it is quite easy to move the whole preamplifier backwards when

sockets. These are not recommended by the Australian electrical authorities. The other distributing feature was the lack of a mains earth. The preamplifier is not double insulated and we would prefer that the preamplifier case be earthed via a 3-core mains flex and 3-pin plug.

The same remarks can be made about the power amplifier, as far as earthing is concerned.

Removing the cover of the preamplifier, reveals a neat and tidy interior. One major PC board is used for the preamplifier, tone filters and RIAA equalisation. The potentiometers for the volume, balance, bass and treble controls are directly mounted on the PC board. The power supply is located



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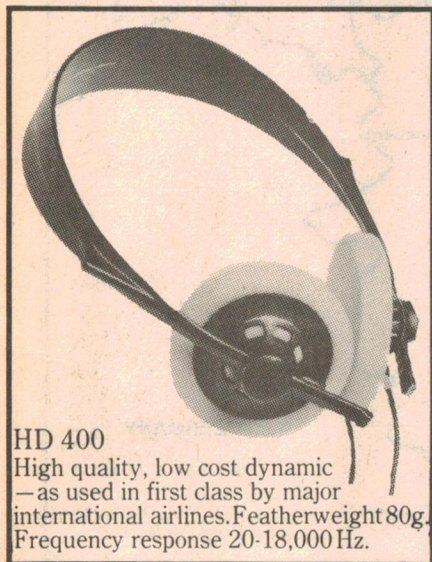
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## HAFLER DH-101 and DH-200

within a shielded area of the preamplifier case to eliminate hum radiation into the low level circuitry. A small PC board is provided for the power supply and another two small PC boards for the switch wiring.

Discrete transistors are used in the preamplifier circuitry and an unusual feature is the passive tone controls rather than the more common active controls.

On the rugged power amplifier, there are no controls apart from the on/off switch. An over-temperature alarm in the form of a light is also on the front panel adjacent to the on/off switch. Four binding posts at the rear of the amplifier are fitted for connection of loudspeakers.

Removing the power amplifier cover reveals that the two large finned heat sinks provide the structural rigidity for the chassis. Each heat sink accommodates two complementary pairs of Hitachi power MOSFETS (2SJ49/2SK134) as well as the associated PCB. The power supply is generously rated, using a large power transformer with copper strap and pressed end covers to keep stray hum fields to a minimum.

The transformer drives a bridge rectifier and two large 10,000uF/75VW filter capacitors.

We began our performance tests of the DH-101 preamplifier and DH-200 power amplifier with the standard one hour preconditioning, with both channels delivering 40% of rated power. This resulted in the heat sinks of the power amplifier rising to a mere 50 degrees Celsius with the ambient temperature at 20 degrees. This indicates that the heat sinks are more than adequate for the job.

Hafler rate their power amplifier output at 100 watts RMS per channel, with both driven into eight ohms for a distortion of less than 0.02% over the frequency range of 20Hz to 20kHz.

We measured 120 watts per channel with both driven into eight ohms, at the onset of clipping. With four ohm loads, the power was 200 watts per channel with both driven. These power figures rise to 160 watts and 260 watts respectively with single channel operation.

The combined harmonic distortion figures for both preamplifier and power amplifier revealed 0.015% at 1kHz and rated power, which rose to 0.04% at 10kHz. At lower powers the distortion was typically 0.01%.

Intermodulation distortion measured with 50Hz/7kHz signals in a 4:1 ratio was 0.012% into eight ohms at 100 watts.

Frequency response at one watt into eight ohms is -0.5dB down at 10Hz and 20kHz. The -1dB point at high frequencies is at 30kHz.

Photo sensitivity was 2.6mV for 100 watts output at 1kHz. Signal-to-noise

ratio with respect to 10 watts and 10mV was 65dB unweighted, with a typical magnetic cartridge connected.

Sensitivity for the tuner and auxilliary inputs was 150mV for 100 watts output at 1kHz. Signal-to-noise ratio was 85dB with respect to 100 watts. Separation was 41dB at 10kHz, 57dB at 1kHz and 59dB at 100Hz, with respect to full power and with the undriven channel input weighted with 4.7k $\Omega$ .

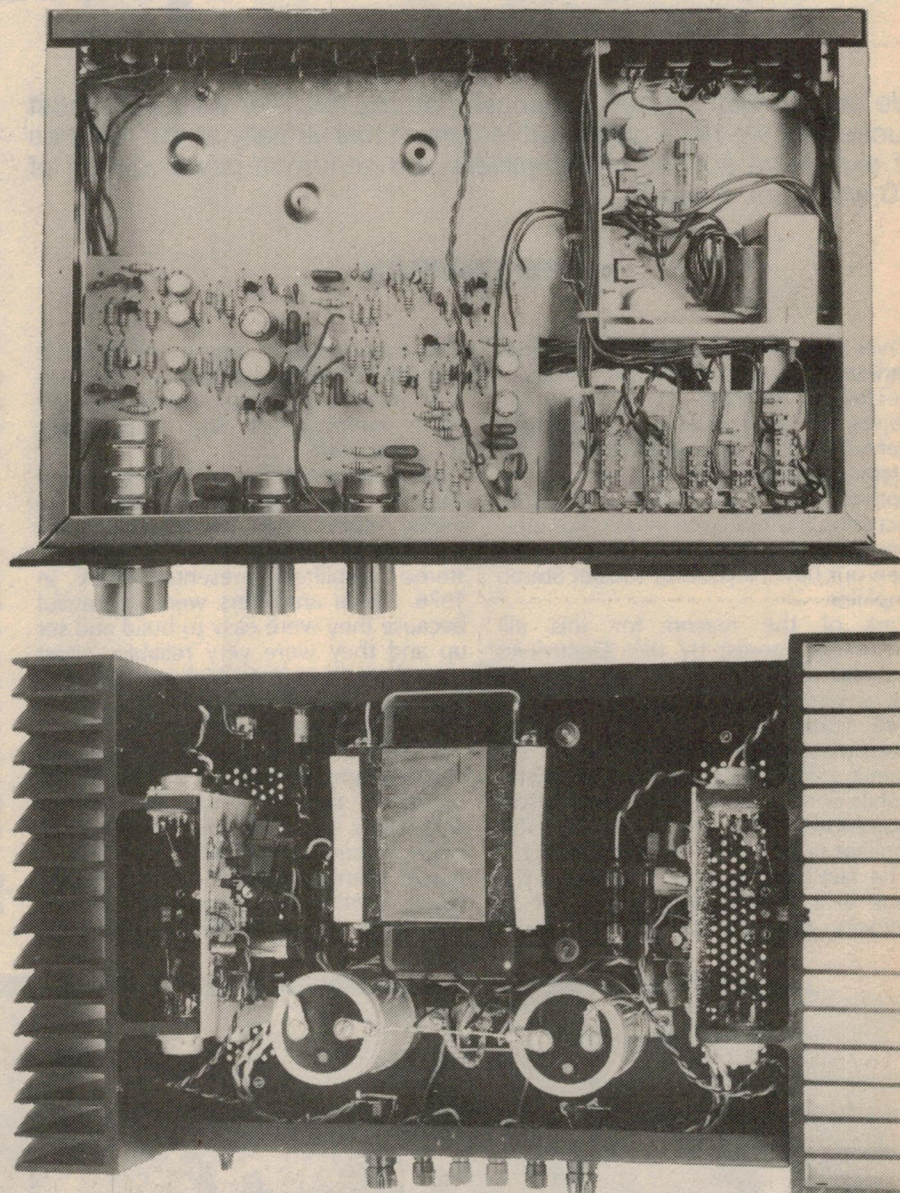
The tone controls provide  $\pm 10$ dB

and the control of the speakers, especially at low frequencies, is excellent.

Stability of the amplifier is impressive. Under the most severe capacitive loads, the amplifier exhibited a clean square wave response with little ringing. We can safely say that the amplifier is unconditionally stable.

Listening tests confirmed the impressive performance of the Hafler DH-101/DH-200 combination. The amplifier certainly has generous headroom and can deliver a very clean, uncoloured sound at high levels.

The amplifiers are available either fully built or in kit form, and for those who are



boost and cut at 10kHz for the treble control and +13.5dB and -15dB at 50Hz for the bass control.

RIAA equalisation is rated at within  $\pm 0.5$ dB from 40Hz to 15kHz and we measured within  $\pm 0.25$ dB from 30Hz to 15kHz and within  $\pm 0.75$ dB from 20Hz to 20kHz, well within specification.

Damping factor of the power amplifier is 120 at 1kHz and below and 60 at 10kHz. These damping figures are good

interested in high performance with no fancy extras, the Hafler amplifiers deserve a second look. Price of the DH-101 preamplifier is \$398 in kit form and \$498 fully assembled. The DH-200 retails in kit form for \$675 and \$775 for the assembled product.

Further information on Hafler equipment can be obtained from Concept Audio, 22 Wattle Road, Brookvale, NSW. (J.C.)



*A preview of our new powerful stereo amplifier*

# Playmaster Mosfet Stereo Amplifier

We believe that this new Playmaster stereo amplifier will be the most successful we have published to date. It has virtually all the features of expensive commercial amplifiers and generous power output of 50 watts per channel.

by LEO SIMPSON

Over the last few months one topic has dominated conversation at the offices of "Electronics Australia". It has been the subject of much trial and tribulation. There have been heated discussions, impassioned pleas on one aspect or another. The topic of all this animated discussion has not been inflation or elections or computers. No, the topic has been our new Playmaster Mosfet Stereo Amplifier.

Part of the reason for this all-consuming interest by the "Electronics Australia" staff in the new amplifier is that at least five of those staff members were actually involved in the design, construction and presentation of the project while all the others had a worthwhile contribution in the form of ideas, suggestions and reactions. So this amplifier is very much a team project.

The fact that the new amplifier is the result of a team effort is partly due to necessity. A project such as this could

take a much longer time to develop if it was the sole effort of one man. And partly it was due to particular interest by each member of the "Electronics Australia" staff.

We were conscious that we had a very hard act to follow in the form of the highly successful Playmaster Twin Twenty-Five and Playmaster Forty-Forty stereo amplifiers presented back in 1976. These amplifiers were successful because they were easy to build and set up and they were very reliable. Apart from that, they gave a high order of performance at a fraction of the price of an equivalent commercial amplifier.

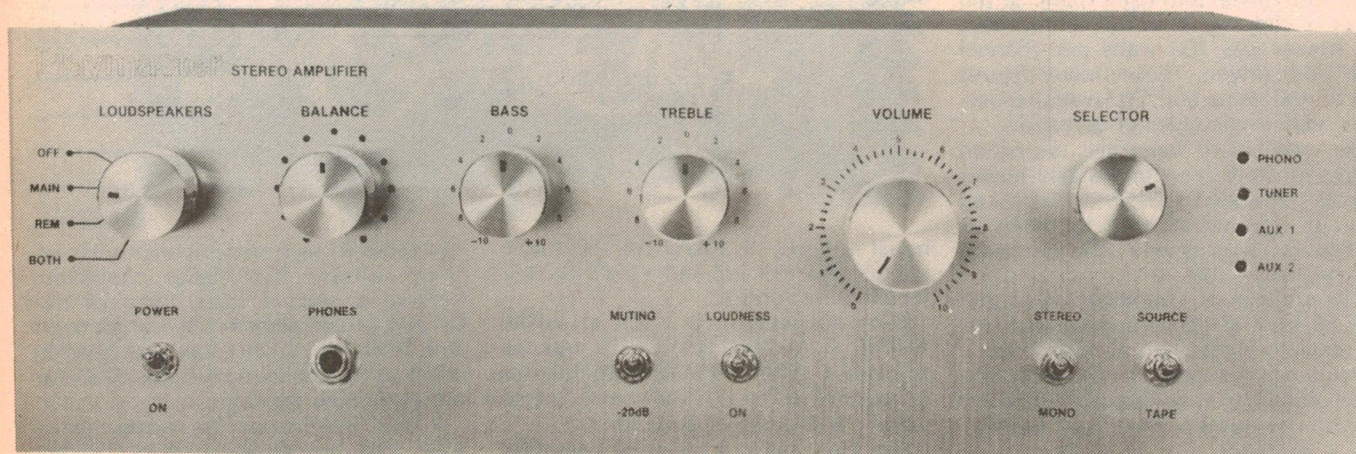
So we were conscious of the fact that our new amplifier would have to equal or better the Twin Twenty-Five and Forty-Forty series. In that respect, we were helped by the fact that Mosfet power transistors have now become readily available at reasonable prices. This gives our amplifier an advantage

over most commercial amplifiers because only a few very expensive amplifiers on the market employ these devices.

Our new amplifier has a relatively large and impressive front panel with anodised scratch-grain finish together with a fine array of imported knobs. In this respect, it will match the well-finished exterior of typical commercial amplifiers. Where it beats many commercial amplifiers is in its single-PCB design with a minimum of wiring and good accessibility should service be required in the future.

That is another point in favour of the new Playmaster amplifier in comparison with many commercial amplifiers. Whereas, all the parts for the present Playmaster series and our new amplifier can be readily purchased over the counter, virtually anywhere in Australia, just try and do the same with any of the semiconductors in a typical commercial amplifier. If you wish to be able to service your amplifier in the future, rather than ship it to a national distributor's service centre at great cost, then the Playmaster is the one to go for. To be fair, the Playmaster will not have a 12-month warranty after you put it together. But you cannot have everything.

Let us now discuss the features and



Our new Playmaster Mosfet stereo amplifier has all the control features of the successful Playmaster 40/40 plus Loudness control, 20dB Muting, switching for two pairs of loudspeakers and source indicator lights.



facilities of the new amplifier and then we can proceed to talk about the circuit.

The front panel has been designed with the controls in a conventional and logical layout. In common with most other amplifiers, the volume control is the most prominent knob, for easy recognition.

Some of the front panel features are new to Playmaster amplifiers. They include muting, loudspeaker switching and a loudness control. What! A "loudness" control? Has "Electronics Australia" finally sold out and given up all its high principles? Has it been taken over by a multinational? Has the Technical Editor had a frontal lobotomy?

No, none of these events have transpired. We have actually bowed to pressure from the many readers who have written in the past complaining that the Playmaster Twin Twenty-Five and Forty-Forty did not have a loudness control. We were anticipating a repetition of this with the present amplifier and so we "went to water" before the event.

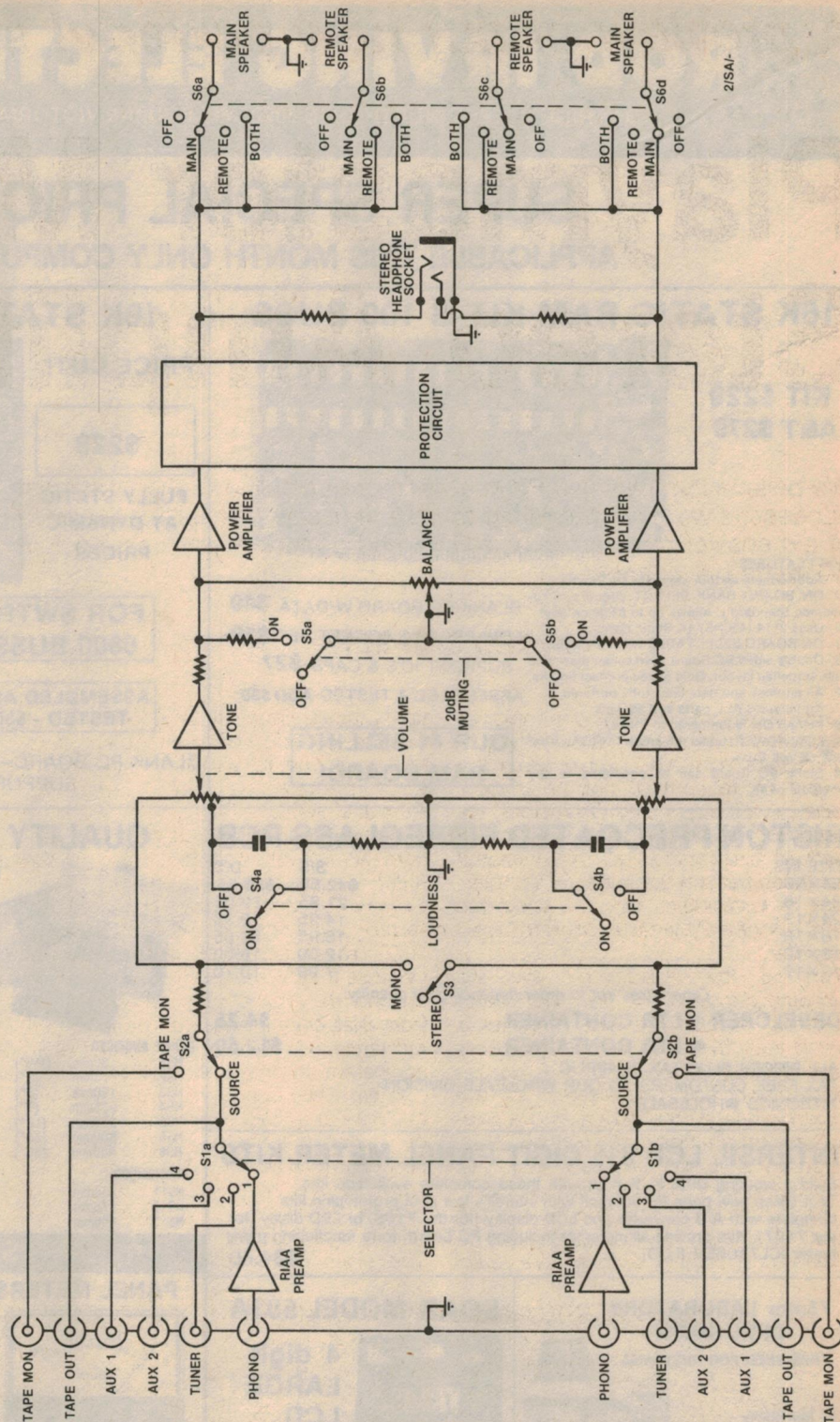
Actually, this allows the writer to sit comfortably on the fence. On the one hand, he can say that the design caters for the requirements of constructors and on the other, he can state that anyone who actually uses the loudness facility is a Philistine. What's that you say? You like using the loudness control? You poor demented soul.

Reference to the block diagram for the complete amplifier will show how the facilities are provided. Any of four stereo sources can be selected by the two-pole switch S1. Signals from a magnetic cartridge (phono) are first fed to an RIAA equalisation preamplifier before going to the selector switch S1.

Output signals from the Selector switch, S1, are fed to the "Tape Rec." terminals for connection to any tape recorder or cassette deck. At the same time, the signals are fed to the "Tape Monitor" switch S2, which gives the user a listening choice between the signal from the Selector switch or the playback signals from the tape deck. The Tape Monitor switch also allows simultaneous monitoring of the signal being recorded when a three-head tape deck is employed.

From the Tape Monitor switch, S2, signals are fed via  $4.7k\Omega$  resistors to the Stereo/mono switch, S3 and the  $50k\Omega$  ganged volume control. The  $4.7k\Omega$  resistors are inserted in the signal line to prevent distortion due to the heavy loading effects of one channel on the other if they are merely shorted together to produce the mono mode. To explain this further, consider the RIAA preamplifier which has a very low output impedance due to the considerable negative feedback in the circuit.

Now if there is an output signal from the left preamplifier and a completely dissimilar or no output signal from the right channel preamplifier, the right channel preamplifier will heavily load



This diagram illustrates the facilities offered by our new stereo amplifier. The protection circuit also provides turn-on and turn-off muting.

the output from the left preamplifier if the two outputs are merely shorted together by the stereo/mono switch. This is because the left preamplifier "sees" a heavy load presented by the very low output impedance of the right channel preamplifier. But matching a low impedance to another low impedance is not the problem — the preamplifier just cannot deliver the heavy currents which would otherwise flow. With the  $4.7k\Omega$

resistors in circuit, each preamplifier (or any other source selected by S1) "sees" a minimum load of approximately  $10k\Omega$  when S3 is switched to provide the mono mode.

So far then, the input facilities are no different from those on most other commercial stereo amplifiers with the exception that the stereo/mono switch is often omitted on less expensive models. We have included it for a number of reasons:



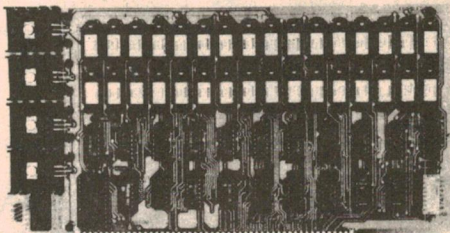
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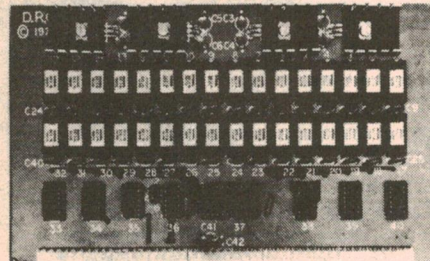
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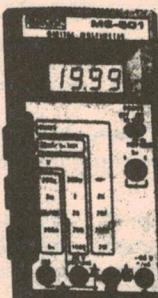
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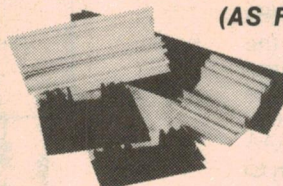
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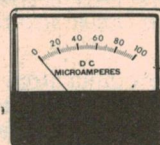
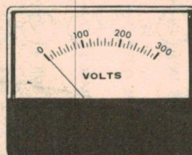


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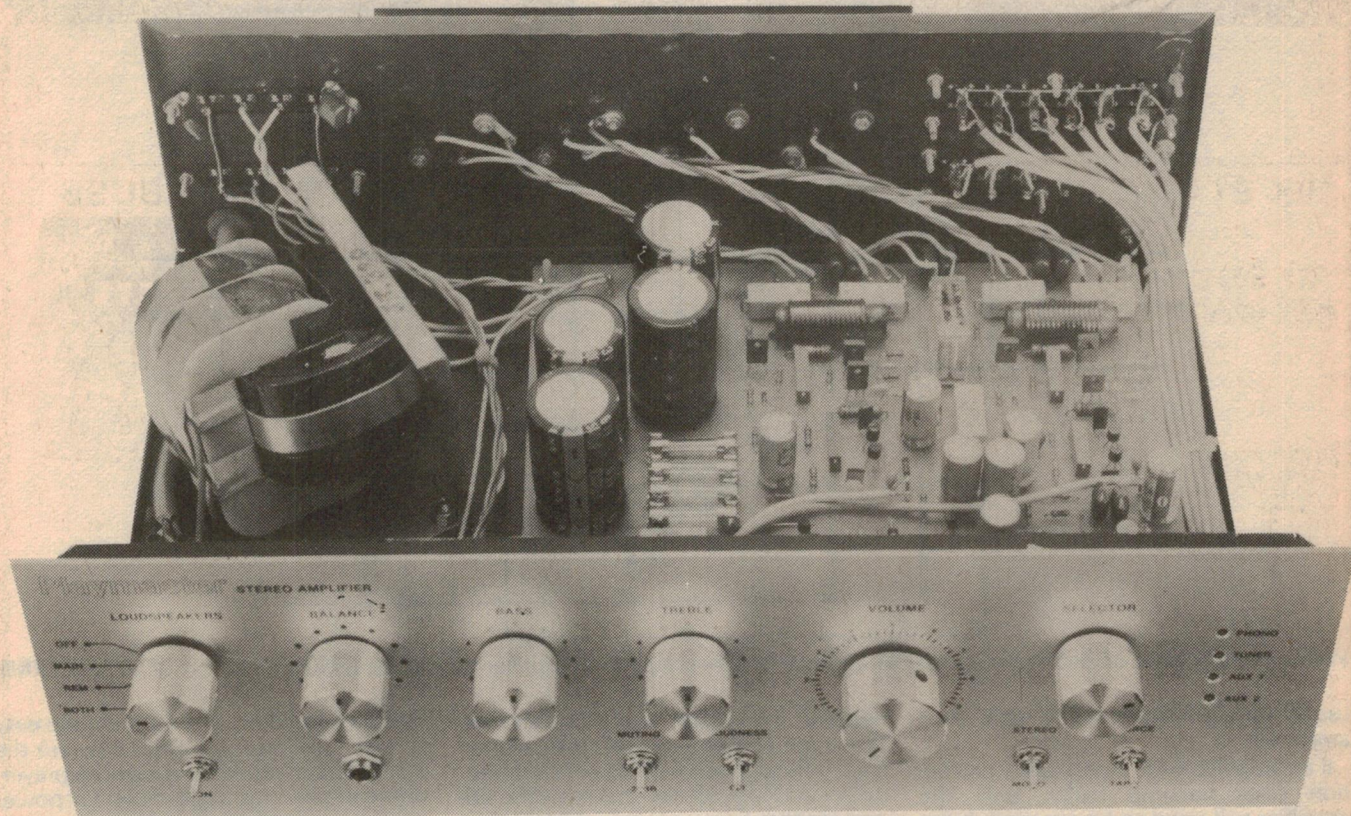
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It enables a mono signal to be reproduced in both channels, and also enables a noisy stereo program to be reproduced in mono which results in cancellation of the "difference" noise components. As well it enables a quick listening check for correct phase of the loudspeakers — if correct, a mono signal will appear to come from a point midway between the two loudspeakers.

Following the stereo/mono switch is the ganged volume control for both channels of the amplifier. Thus the high level signals (100mV or more) must pass via the volume control before they are fed to the active tone control stages. This ensures that the tone controls are never overloaded (unless of course the following power amplifier stages are grossly overloaded).

The volume control is tapped at 40% of rotation to provide that (controversial) loudness facility. This feature is no more valid than the loudness controls on any other amplifier but it should make some readers happy. It provides bass boost but no treble boost.

Output signals from the tone control stages are fed to the balance control and thence to the power amplifiers via 4.7k $\Omega$  resistors. These resistors combine with the balance control to provide smooth control action and at the same time, en-

sure that neither of the tone control stages is unduly loaded when the balance control is rotated to either extreme. Without the 4.7k $\Omega$  resistors the output of the tone controls could be completely shorted when the balance control was rotated to one extreme.

Associated with the balance control and its just-mentioned 4.7k $\Omega$  resistors is the two-pole muting switch S5. This provides a signal reduction of 20dB by means of additional resistors shunted across the balance control. The muting feature is handy for temporary interrup-

tions to your listening such as telephone conversations. It is also useful for background listening where very low settings of the volume control may cause one channel to be cut off.

Following the power amplifiers is the loudspeaker protection circuit which disconnects the load if an amplifier fault imposes DC voltage on the output. This circuit also provides a delayed turn-on feature to prevent the loudspeakers giving a "thump" at switch-on. While this feature can be optional, we regard it as highly desirable as loudspeakers are

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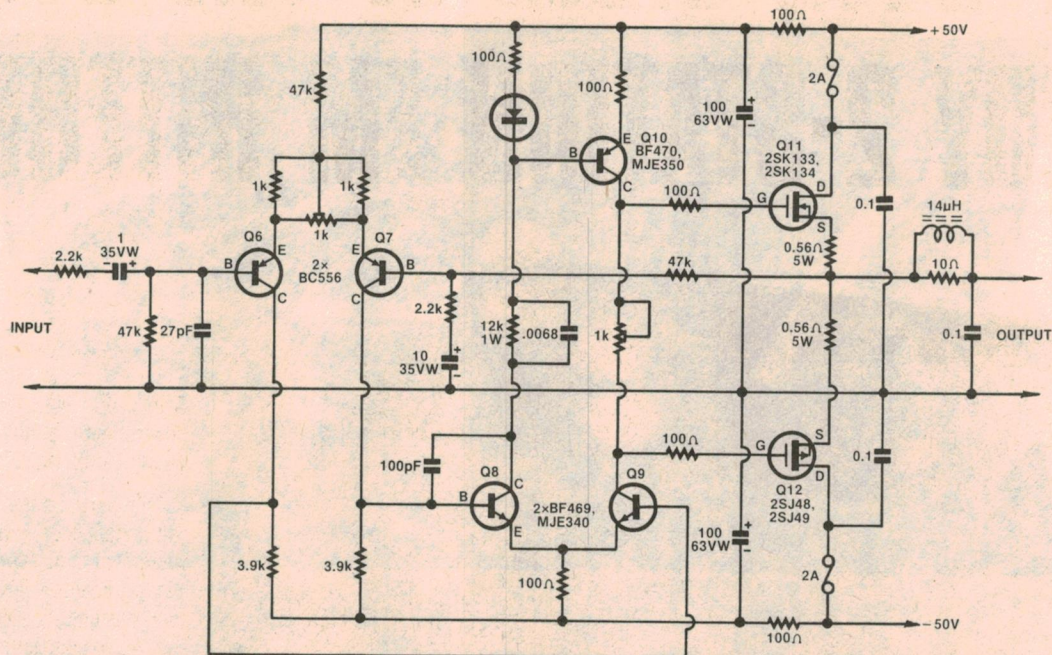
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usually far more expensive to repair than amplifiers.

If an amplifier with loudspeaker protection does become faulty, only the amplifier will need to be repaired. If the amplifier does not have protection for the loudspeakers, the total repair bill for loudspeakers and amplifier can be much more expensive. In our opinion, all amplifiers capable of more than about 20 watts or so, per channel, and having direct-coupling to the output, should have loudspeaker protection.

Following the loudspeaker protection circuitry is the four-pole loudspeaker switch S6, which gives a choice of one or both of two pairs of loudspeakers or switching the loudspeakers off. The headphone drive is not affected by this switch.

On the rear panel all small signal con-

nections are made via RCA sockets. These are compatible with the connecting leads supplied with most turntables, tuners and tape decks and have the advantage that they are easier to wire than DIN sockets. Nor is there any problem with wiring convention as there is with DIN sockets.

Loudspeaker connections are made via spring-loaded or screw terminals which have the advantage that connections are easily made without the necessity for soldered plugs.

Also mounted on the rear panel is a large single-sided heatsink which accommodates the four Mosfet power transistors.

That leads us to the next topic in this article – a discussion on the pros and cons of power Mosfets.

To read some of the promotional infor-


mation on power Mosfets, it is quite easy to gain the impression that they are the answer to an amplifier designer's prayer. Some of the advantages listed for power Mosfets are as follows:

- (1) They require a very low driving power as they are voltage-controlled devices.
- (2) Good frequency response and high switching speed due to absence of carrier storage effect.
- (3) Free from current concentration, so no Second-Breakdown.
- (4) Negative temperature coefficients so no thermal runaway
- (5) High input impedance and high gain.



Taken separately, all these characteristics are present in power Mosfets. But, as we shall see, that "ain't the whole story", not by a long shot. When you want all those characteristics together the rainbow begins to fade away.

Let us have a look at the first two characteristics and see how they work out in practice. Yes, it is true that Mosfets are potentially capable of excellent high frequency response, especially when used as source followers. However, this is only true if the Mosfet is driven from a low source impedance, ie, a voltage source. As soon as the source impedance becomes appreciable, say 1k $\Omega$  or more, the Mosfet source follower is not much better than a typical bipolar power transistor such as the common "garden-variety" 2N3055 (when driven from a voltage source in the same mode).

The reason for this effective loss of high frequency response is the very high input capacitance of typical power Mosfets.



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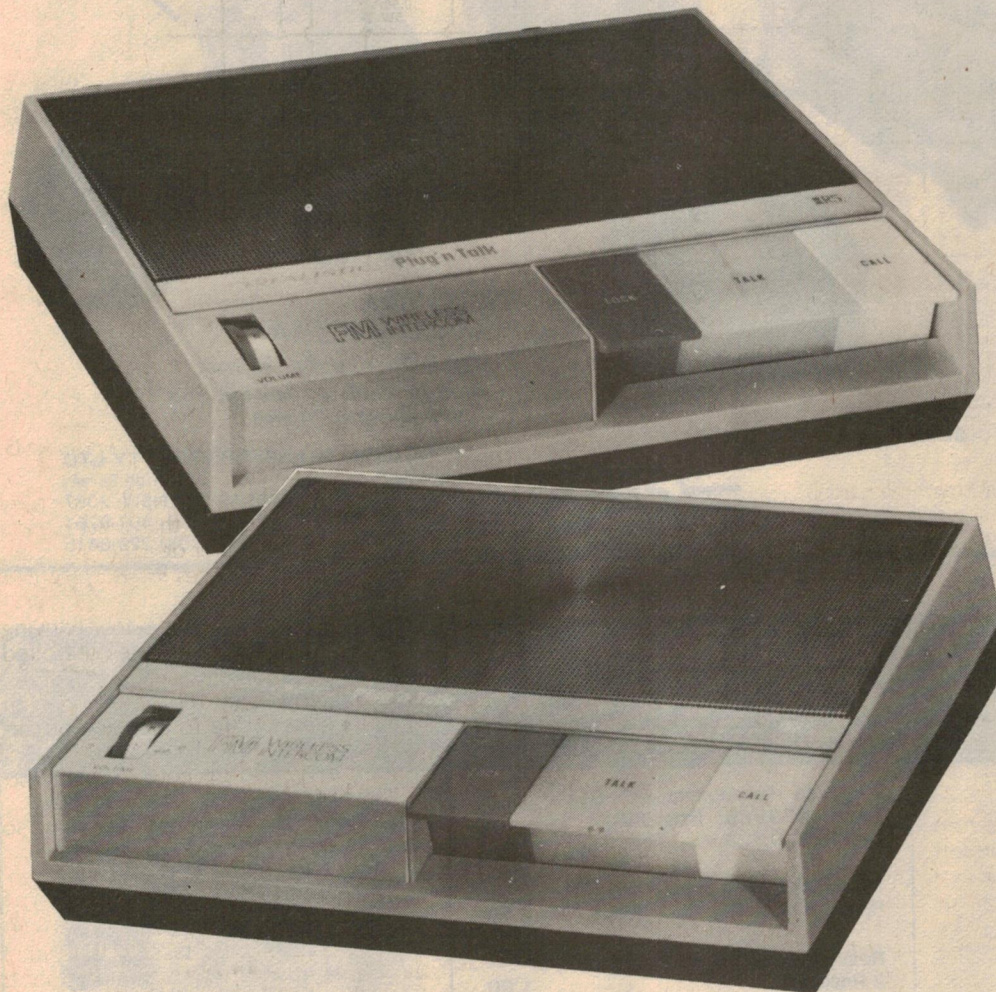
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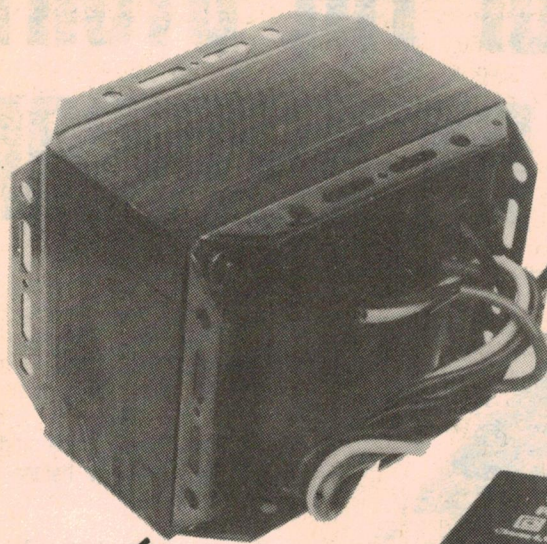
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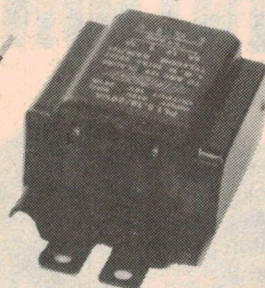
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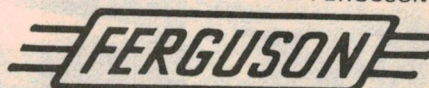


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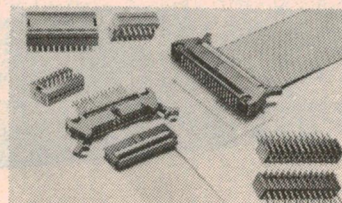
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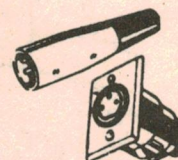
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## PLAYMASTER STEREO AMPLIFIER

This is typically 400pF or more for the devices used here. So, the ability of the Mosfet to function as a voltage controlled device is not a virtue but a necessity, if high frequency response is to be obtained.

And if a voltage source is required (ie, low source impedance) then the advantage of high input impedance is lost. In fact, to judge from a number of commercial amplifier designs we have seen, the only really effective way of obtaining wide bandwidth (ie, up to several Megahertz or more) from a power Mosfet output stage is to drive it with emitter-followers. But to do that largely negates the fourth advantage listed above; no thermal runaway.

Used in a class-B output stage by themselves, power Mosfets exhibit a negative temperature coefficient of drain current versus gate voltage, provided the drain current is around 100 milliamps or more, for the particular devices used in our circuit. This means that the familiar "Vbe multiplier" transistor which provides quiescent current stabilisation in typical bipolar amplifiers can be dispensed with. But if complementary emitter-followers are used to drive the Mosfet output stage, the Vbe multiplier must be incorporated.

Another disadvantage of the use of emitter-followers is that it can make the amplifier harder to stabilise because the emitter-followers insert another "pole" in the open-loop characteristic. Put another way, this means that the emitter-followers have their own frequency rolloff characteristic which is added to the rolloffs due to other stages in the amplifier.

Power Mosfets are also prone to oscillate parasitically in high-gain amplifiers and the most effective cure for this is to add "stopper" resistors of several hundred ohms in series with the gate electrodes. This cures the oscillation problem (usually) but also reduces the gain-bandwidth product, as explained above.

Perhaps the major advantage of power Mosfets is their freedom from second-breakdown effects. This means that there is no need to derate the device when operating at high voltage, as is the case with all bipolar transistors. This means that a given pair of 100W Mosfets can be used to provide a higher rated amplifier which would be more tolerant of variations in load impedance and phase angle, than would be the case with equivalent bipolar transistors.

One other aspect should be mentioned, that of junction temperature. The maximum junction temperature of the Mosfets used here is 150 degrees Celsius while typical bipolar power transistors have a junction temperature rating of 200 degrees Celsius. While this would

seem to limit the Mosfet unduly, the fact that they tend to "shut down" at high temperatures means that they are inherently self-protecting which is definitely an advantage.

Now let us discuss the power amplifiers which are based on a circuit provided in application literature published by Hitachi Semiconductors, Japan. Hitachi Mosfets are distributed in Australia by Plessey Components, Christina Road, Villawood, NSW and they will be available at a number of major kit suppliers.

We were unable to use the Hitachi circuit in its original form, for two reasons. The first was that it depends on rather special driver transistors which are unavailable in Australia and second, we could not make it work in a practical layout — it oscillated furiously at very high frequencies. So we have produced a modified version which is unconditionally stable while still giving creditably low distortion and lots of power. There are, undoubtedly, other more complicated circuits giving lower distortion but a simple circuit is generally more reliable and trouble-free.

Now refer to the circuit diagram of the power amplifier. The input stage is a differential amplifier employing two high voltage PNP transistors, Q6 and Q7. This drives another differential pair, using NPN transistors Q8 and Q9 together with current mirror Q10. This class-A driver stage then feeds the output power Mosfets via 100Ω stopper resistors.

Quiescent current is set in the output stage by the variable 1kΩ trimpot connected between the collectors of Q9 and Q10.

Voltage gain of the power amplifier is set by the ratio of the 47kΩ and 2.2kΩ resistors at the base of Q7. The lower cutoff frequency is set by the 10μF capacitor in series with the 2.2kΩ resistor. This capacitor also sets the DC feedback at 100% which means that the DC gain is unity.

Output offset voltage adjustment is provided by the 1kΩ trimpot between the emitters of Q6 and Q7. This allows the output offset voltage to be set to less than ±1mV. Without this circuit feature, the offset voltage could be expected to be typically around ±50mV or less. While ideally the offset voltage should be as close as possible to zero, the main reason for incorporating offset adjustment in our circuit is make the relay protection circuit silent; if there is appreciable offset voltage, the relay will produce an audible "click" from the loudspeaker when it switches on and off.

Source degeneration via the 0.47Ω resistors is provided in the output stage. This reduces the high frequency rolloff which would otherwise occur due to the high input capacitance of the Mosfets. It also allows a reduction in the optimum

quiescent current for thermal stability which means that there is less power dissipation under "no-signal" conditions. Translated, this means the output Fets run cooler.

Single-pole lag compensation is applied from the collector to the base of Q8 via a 100pF capacitor. This renders the amplifier stable with overall feedback applied.

A final refinement is the RLC network in the output circuit. This is based on a paper by A. N. Thiele and published in the September 1975 issue of "Proceedings of the IREE". This, and other measures, renders the amplifier unconditionally stable. There is a proviso here, in that short circuits or very large capacitive loads will cause the fuses to blow.

(To be continued)

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by RON DE JONG

Perhaps we should point out that Lotto is played only in NSW, with a similar game called Tatslotto in Victoria. For the benefit of readers in other states, Lotto is a betting game in which one enters coupons containing a number of "games". Each game consists of 40 squares, numbered 1 to 40, and in a standard game the player fills in six squares of their own choice. If those numbers come up in the weekly draw, the player can win a lot of money!

With first prizes ranging up to one million dollars (or more) it is not surprising that Lotto is popular. And, cashing in on this popularity, there have now appeared devices called Lotto selectors; gadgets designed to take the strain and hassle out of deciding which numbers to pick for each game.

They are quite elementary mechanical

devices, but have proved extremely popular. One typical version consists of a plastic case in which there are two channels, each numbered non-sequentially with 20 positions. Adjacent to the channels is a clear area in which are parked 40 small ball bearings, 34 silver and six black. The whole assembly is housed under a clear plastic lid.

By tilting the package the ball bearings are allowed to run into the two channels and the numbers opposite the black balls are those selected for the coupon.

What is the motivation to use one of these devices rather than make one's own selection of numbers? In fact, there appear to be several reasons for their popularity. One is the purely psychological reaction whereby the individual feels incapable of making a completely random selection of numbers or a selection which, according to signs, portents, superstition etc, has a better than average chance of success.

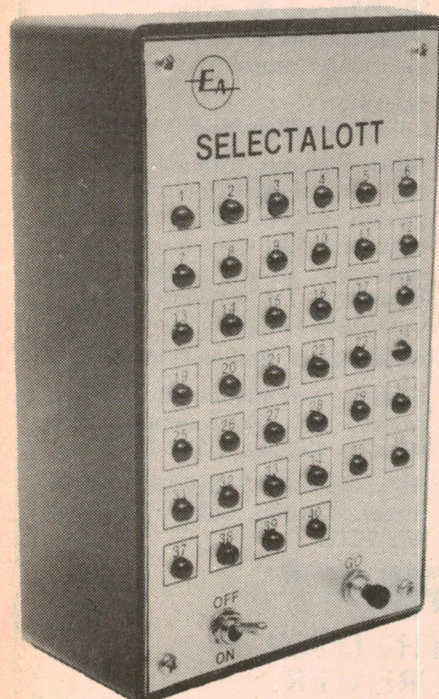
They may also act as a psychological face-saver whereby, when one's selection doesn't win — particularly if it fails by only one number — all the guilt and

blame can be laid on the device, rather than one's own ineptitude. It may also help to prevent domestic arguments, when one party has a preference for certain numbers not shared by the other.

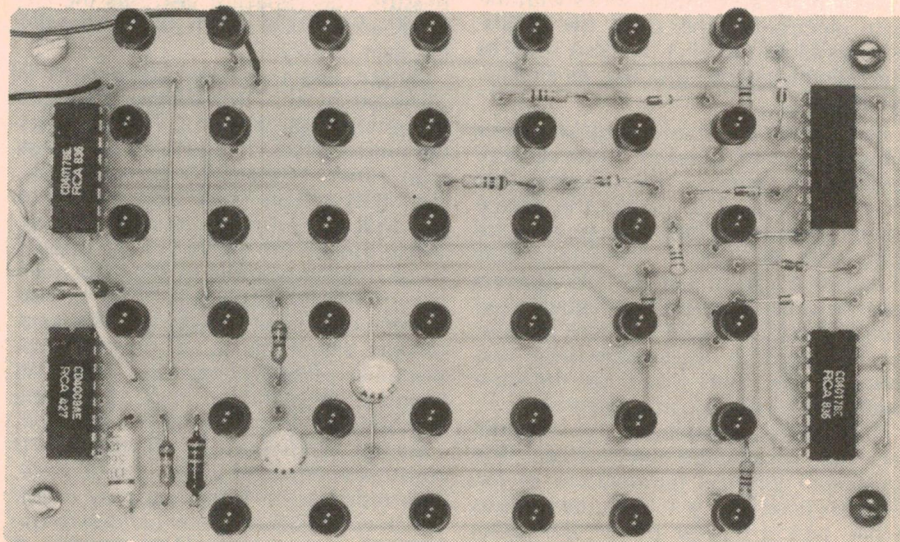
At a more serious level it has been suggested that the human brain is, in fact, a very poor random number generator. The mere fact that we stop to think before we select a number means that our choice is being biased in some way. Some people would not select number 13 in any circumstances; others would be biased against consecutive numbers, low value numbers, or numbers which have already won prizes.

Other biases may be more subtle, to the point that we are not conscious of them, but they exist nevertheless. On this basis an inanimate, non-thinking device becomes a much better random number generator, even though it may still be far from perfect.

In short, there is plenty of justification for a number selector, the only question being what form it should take. While the simple mechanical device we have described will undoubtedly satisfy the

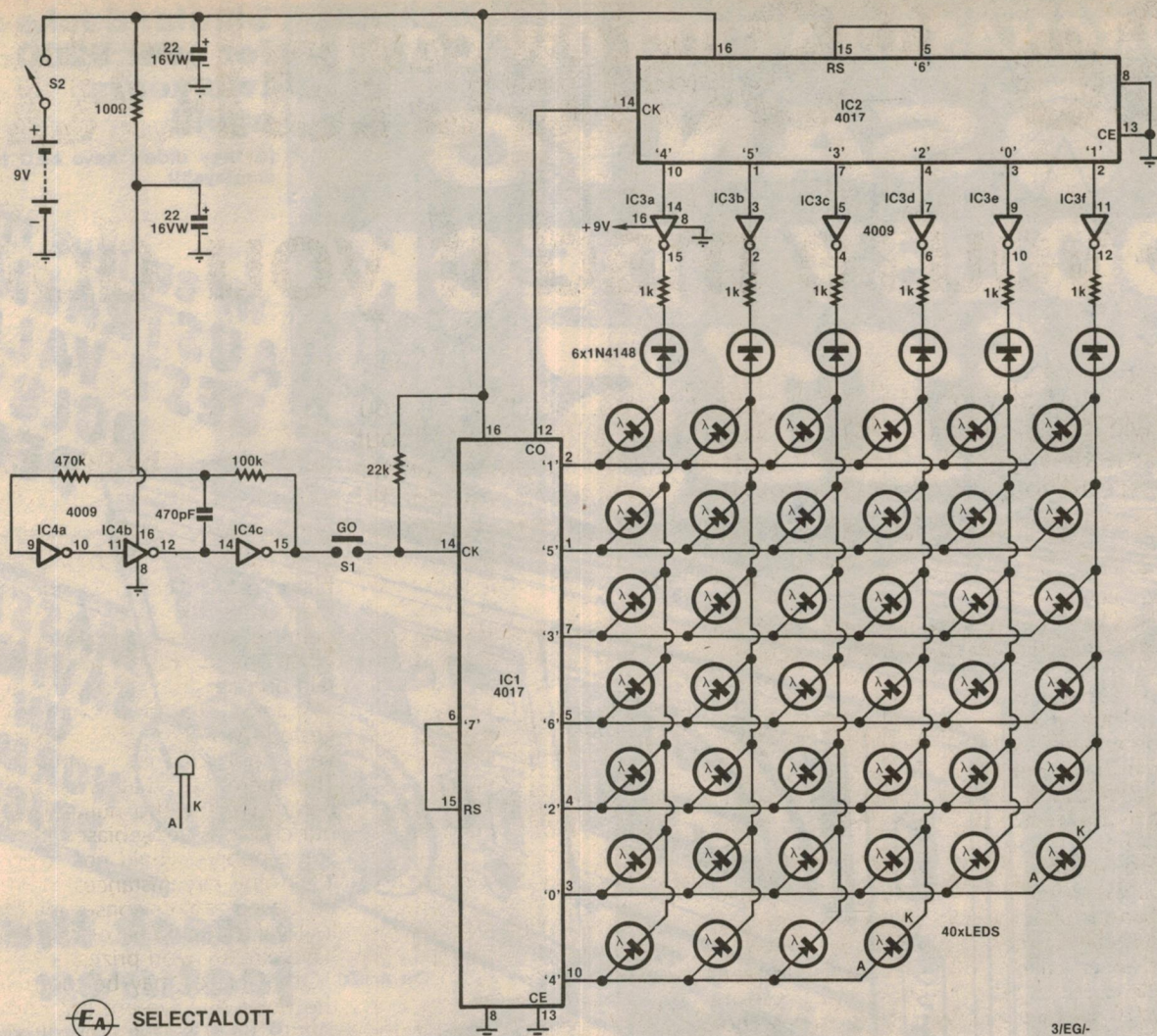


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average player we cannot visualise any full blooded electronics enthusiast – in short, anyone reading this article – being satisfied with anything so elementary.

Not when, for a mere \$20 or so, and a couple of pleasant hours on the bench, he can have a genuine electronic version using the latest space age technology!

In terms of behaviour, our selector may be best described as a 40 sided die, or perhaps more accurately, a 42 sided die with two blanks. The reasons for this qualification will become more evident as the circuit is examined, but it means that there will be odd times when no number comes up and the "throw" is simply ignored.

Another die-like characteristic is that it can produce the same number consecutively, or during the six throws needed to complete a game. Naturally, such a throw is simply ignored.

And while considering the die analogy, it is worth pointing out that it could be used as a simple gambling game in its own right, such as a simplified version of roulette.

The photograph gives a good idea of the physical form of the selector. It has a

large easy to read display consisting of 40 LEDs arranged exactly as on a Lotto coupon. Apart from the on/off switch the only control is the "GO" button. When this is pressed and released one of the LEDs will turn on and this number is crossed off the corresponding square on the coupon.

While it would have been nice to have all six numbers come up on the display simultaneously, this would have made the circuit excessively complex. As it is the circuit is quite simple, as is evident from the diagram. It uses just four standard CMOS ICs; two 4009, and two 4017.

The two 4017 ICs form the heart of the circuit. These devices are decoded decade counters which have 10 outputs labelled "0" to "9". Only one of these outputs is high at a time and they turn on in sequence as the counter is clocked; from "0" to "9" then back to "0" and so on. They also have a reset input which can be used to set the counter back to zero at any point in the sequence.

We have used these counters to scan the display leds, which are arranged in a matrix of six columns, and seven rows

(or six and two third rows, to be exact!). The rows are connected to IC1, and the columns are connected to IC2 via a 4009 hex inverter.

Thus the rows are scanned by IC1, making each row high in turn. At the same time IC2, via the inverter, makes each column low in turn. Since each LED is connected between a row and a column, it will light when its particular row goes high and its column goes low.

The reason for the two blank positions on the die should now be evident. The matrix of six columns of seven rows commits the system to 42 combinations. Since we require only 40, the last two are simply not provided for in the display. But it will sometimes select one

We estimate that the current cost of parts for this project is about

**\$20**

including sales tax.



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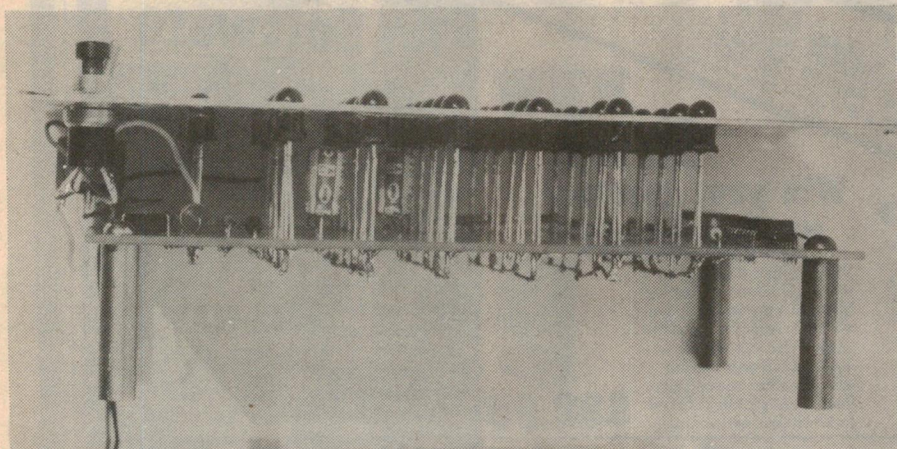
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This side-on view shows the completed board and front panel assembly. Note the wire links connecting the led anode rows on the underside of the PC board.

of these two positions, and give no readout.

The clock pulses for IC1 come from a simple oscillator circuit via the "GO" button and the clock pulses for IC2 come from the output of IC1. When the "GO" button is pressed, IC1 begins counting and its outputs turn on in sequence, causing the LEDs in that column to turn on sequentially. After one column has been scanned the carry output (pin 12) goes high, clocking IC2 so the next column is scanned, and so on until the entire array has been scanned. This occurs much too quickly to be seen but, when the button is released, a random LED will remain on; voila!

As already explained, both these counters count from "0" to "9", which is more than we need. We want IC1 to count from "0" to "6" (rows "1" to "7") and IC2 to count from "0" to "5" (columns "1" to "6"). This is arranged by connecting the next decoded output of each counter to its reset (pin 15) so that, for example, when output "7" of IC1 is reached the counter restarts at "0".

Note that this is usually a bad method of resetting a counter because shortly after the reset signal goes high the counter resets and the reset signal disappears which means that the length of the reset pulse is only as long as the internal reset propagation delay of the counter. In this non-critical application however it is acceptable, but we have taken one precaution. Because IC1 is used to clock IC2 we connected the IC2 clock to the IC1 "carry-out," rather than the reset. The reset pulse may be too short to reliably clock IC2 but the carry-out signal is quite well defined.

Some other features of this matrixing arrangement are the diodes and 1k $\Omega$  resistors in series with each column output from the inverters, IC3. The resistors provide current limiting while the diodes have been incorporated so that, when

an inverter output is high, none of the LEDs will be reverse biased. If they were they would conduct because the reverse breakdown voltage of a LED is a low 3V. The diodes would not be damaged because of the current limiting resistors, but the increased current drain is undesirable.

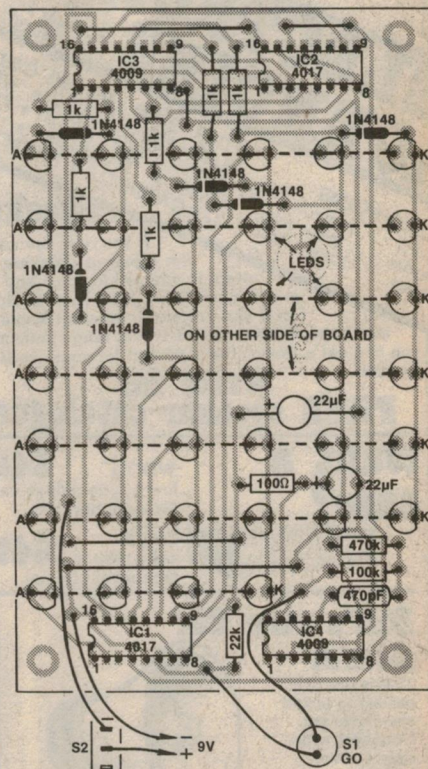
The CMOS oscillator circuit is a standard three gate design. The 100k $\Omega$  and 470pF capacitor determine the operating frequency which, in our case, is about 5kHz. The 470k $\Omega$  resistor provides feedback and isolates the charging waveform from the input protection diodes of IC4a. To reduce the chances of biasing the otherwise random nature of the circuit the power supply to the oscillator is decoupled by a 100 $\Omega$  resistor and 22 $\mu$ F capacitor.

The unit is powered from a single 9V battery such as the Eveready No. 216. Current drain is about 10ma, which should give a life of about 30 hours — a lot of Lotto games.

Construction of the unit is straight forward. All the components except the front panel switches are mounted on a single printed board coded 80Is12 and measuring 79 x 131mm. The actual size artwork is shown elsewhere in this article for those who wish to make their own boards, but finished boards should be available from the usual retailers.

Mount the components on the board according to the component overlay shown in this article. Take care to see that the electrolytics and diodes are correctly orientated and, when installing the CMOS ICs, take the usual precautions against static electricity, viz avoid handling the pins, use an earthed soldering iron and solder the two supply pins first (pins 8 and 16) so as to enable the input protection diodes.

We have used an unusual connection method for the LEDs. Because they are



The wiring diagram for the PC board. Take the usual precautions when soldering the CMOS ICs and don't forget the small wire link near IC3.

## PARTS LIST

- 1 zippy box, 159 x 95 x 50mm (D x H x W)
- 1 PC board, 79 x 131mm, coded 80Is12
- 1 SPST miniature toggle switch
- 1 momentary contact push switch
- 1 9V battery, Eveready No. 216 or similar
- 1 battery clip to suit above
- 4 25mm tapped spacers
- 1 Scotchcal front panel

### SEMICONDUCTORS

- 2 4017B CMOS decoded decade counters
- 2 4009 CMOS hex inverting buffers
- 6 1N4148 small signal diodes
- 40 large red LEDs

### CAPACITORS

- 2 22 $\mu$ F/16VW PC electrolytics
- 1 470pF ceramic or polystyrene

### RESISTORS (all 1/4W 5%):

- 1 x 470k $\Omega$ , 1 x 100k $\Omega$ , 1 x 22k $\Omega$ , 6 x 1k $\Omega$ , 1 x 100 $\Omega$



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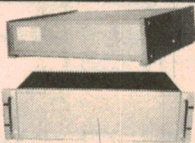
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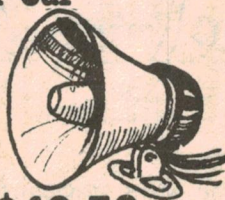
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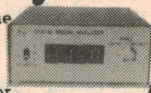


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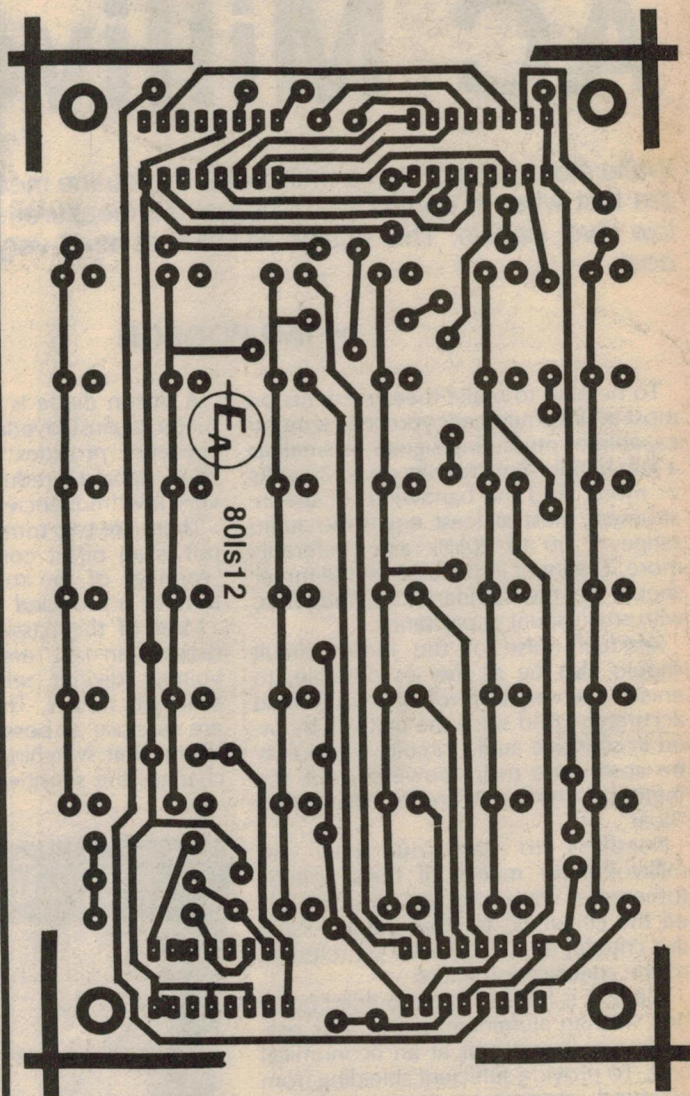
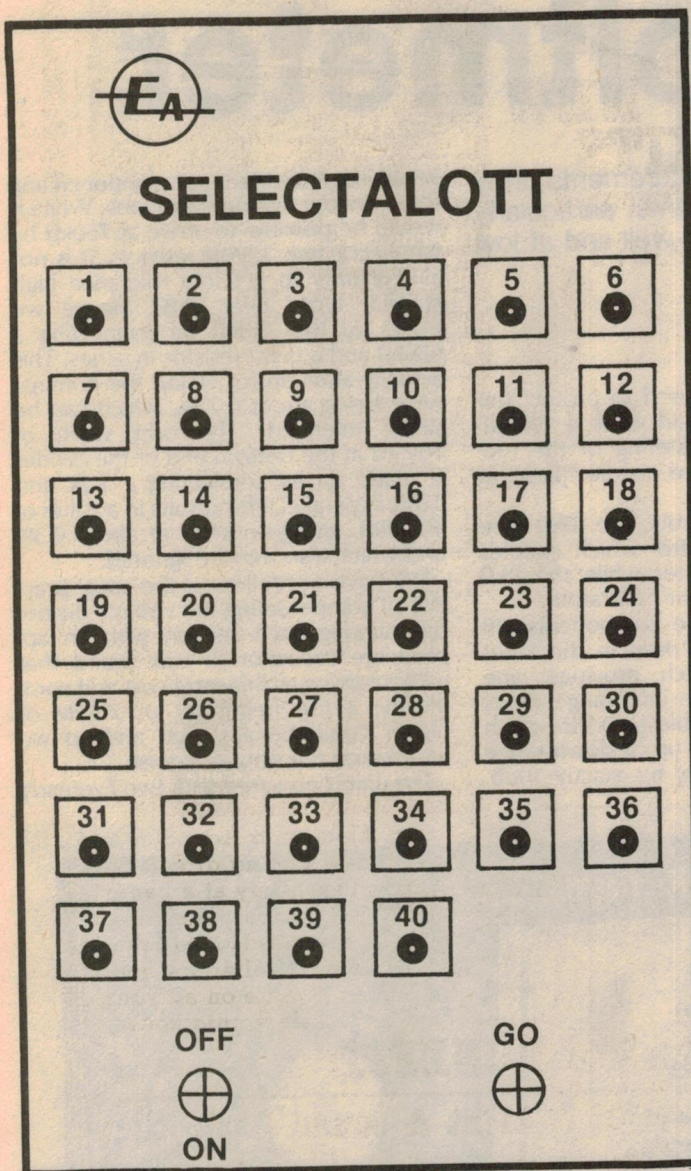
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At left is an actual size artwork for the Selectalott front panel while above is the printed circuit board pattern.

matrixed it would normally require a large number of links or a double sided board to connect them. We have compromised by providing the column connections on the board and making the row connections to runs of tinned copper wire beneath the board. This proved to be a safe and rapid way of doing things.

The method of mounting the LEDs is worthy of some comment. The anode lead is identified by being slightly longer than the cathode and this difference fits in well with the wiring arrangement already mentioned. When the cathode lead is soldered directly to the copper pattern, without trimming, the bottom of the LED should be about 15mm above the board. At the same time, the longer anode lead should protrude about 5mm beyond the copper side of the board, giving sufficient clearance for the runs of

tinned copper wire used to connect them.

We recommend that only a few LEDs be soldered in place initially, the board, front panel, and case then being assembled to check that the dimensions are right and that everything fits. If not, make the necessary adjustments before fitting the remaining LEDs.

Drill holes for LEDs and switches on the front panel next. The actual size artwork for the front panel can be used as a guide for drill centres. A Scotchcal front panel can be prepared from this artwork if photographic equipment is available. Alternatively finished front panels can be obtained from Rod Irving Electronics, PO Box 135 Northcote, Vic 3070 or Radio Despatch Service, 869 George St, Sydney 2000.

If you do use the Scotchcal front panel then drilling holes for the front panel

LEDs is quite a delicate procedure so we recommend the following tips; drill the holes using a small drill then ream them to the desired size, being sure to ream from the front rather than the back of the panel, to avoid lifting the Scotchcal.

You should now be in a position to fire the unit up. One point to check is that when the "GO" button is pressed all of the LEDs appear to glow weakly but all at about the same level. This is due to the multiplexing effect as all the LEDs are scanned, and it provides a quick indication that the LEDs and associated connections are working.

And that is about as far as we can go towards helping you win that million dollars. But who knows, it might just happen. Naturally, if it does, we would appreciate any small token of appreciation you may care to offer.

Good luck!



# Audio measurements are easy with this AC Millivoltmeter

While most people own a multimeter for routine measurements, they are lost when it comes to making audio measurements, particularly low level signals. This design will fill that need very well and at low cost.

by IAN POGSON

To be able to make measurements on most audio equipment you need a meter capable of measuring signals as small as a few hundred microvolts up to 30 volts or more. And the bandwidth of the instrument must at least equal the audio range of up to 20kHz and preferably more. The input impedance of the meter should be the standard one megohm, with small shunt capacitance.

Residual noise of the meter circuit should also be as low as possible, to enable the very low voltages to be read accurately. And since the unit will be used in sensitive audio circuits which may be upset by a mains-powered unit, the meter is battery powered so that it may "float".

Needless to say, our new AC millivoltmeter meets all these criteria (otherwise, we would not have published the circuit or, for that matter, listed the criteria) as can be seen by referring to the specification panel.

The unit is housed in a moulded utility box with an aluminium panel. This provides a compact unit at an economical cost. To provide sufficient shielding from electrical interference, a metal plate is also necessary on the bottom inside of the box.

Few components are used in the circuit and these are readily available at low cost. Just two integrated circuits and five diodes comprise the list of semiconductor devices. The integrated circuits are CA3140 Fet-input operational amplifiers. We used two op amps to obtain the necessary high overall gain and wide frequency response.

Both op amps are connected as non-inverting amplifiers and are AC-coupled. The first amplifier has a voltage gain of about 30. The second op amp functions as a current driver with the meter movement placed in the negative feedback network. This has the effect of cancelling the non-linearity and voltage drop of the diode bridge network.

Even so, germanium diodes have been specified in preference to silicon types because their lower forward voltage drop reduces the output slewing requirement of the op amp. This translates to improved bandwidth.

A silicon diode is used to protect the meter against overload while a 1000 $\mu$ F capacitor provides filtering of the rectified signal to reduce needle "jitter" at very low frequencies.

There are two trimpots. The 10k $\Omega$  trimpot is an offset control which enables "zeroing" of the meter while the 1k $\Omega$  trimpot is provided for calibration.

Most of the passive components, 18 resistors in fact, are used in the input voltage divider which provides nine switched ranges. The inter-range ratios are as close as possible to 0.316 which means that switching up or down range changes the sensitivity by exactly 10dB.

paralleling the values just mentioned and these are the two end positions. While it would be possible to arrive at 750k $\Omega$  by paralleling two 1.5M $\Omega$  resistors, it is not always easy to get low tolerance high stability types over 1M $\Omega$ . Hence we made up the 750k $\Omega$  by connecting a 680k $\Omega$  and a 68k $\Omega$  resistor in series. This actually adds up to 748k $\Omega$ , the nominal error being about 0.27%, which can be safely tolerated. The odd value of 109.4 $\Omega$  at the bottom end of the divider is made up by connecting a 1.2k and 120 $\Omega$  in parallel. This results in a value of 109.09 $\Omega$ , giving an error of about 0.3% and which also may be ignored.

We have not followed the usual practice of compensating the voltage divider by shunting each section with an appropriate capacitor. It was found that without going to this extra cost and complexity, a top frequency of 20kHz or higher could be achieved and so we have taken the simpler course.

The unit is powered with two Eveready



With nine ranges and three meter scales, including a decibel scale with zero reference of one milliwatt into 600 $\Omega$  (774.6 millivolts RMS) our new AC Millivoltmeter is a handy instrument for audio measurements.

This is very handy for measuring signal ratios in audio equipment.

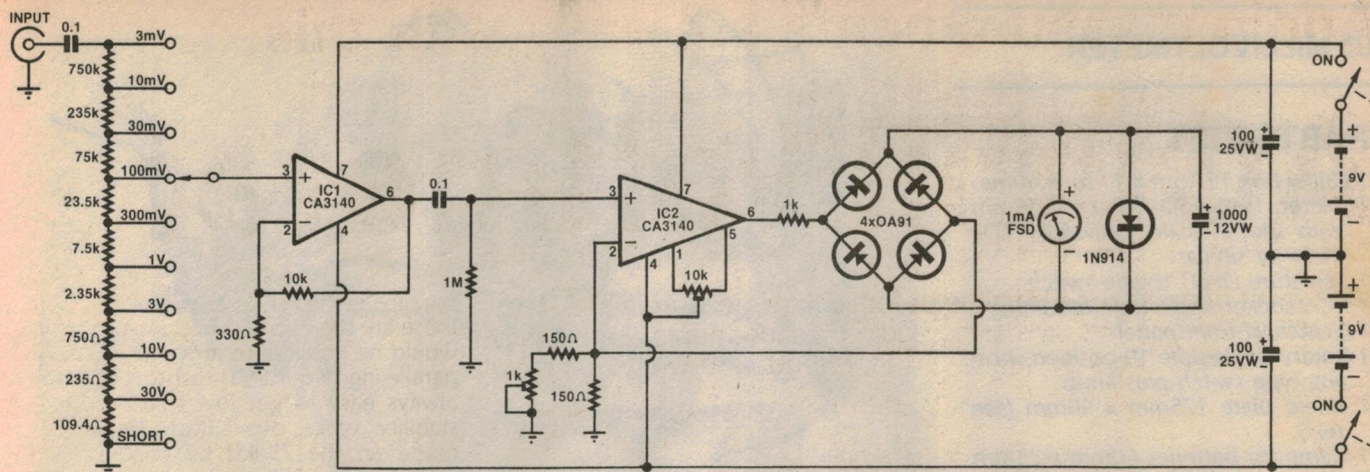
The total resistance of the voltage divider is one megohm, and to arrive at the 0.316 ratio mentioned previously, the resistor values are 75 and 23.5. These are obtained by paralleling the preferred values of 150 $\Omega$  and 47 $\Omega$  or multiples thereof.

There are two exceptions to the idea of

216 9V batteries. With a current drain of only 5.5mA from each battery, they should last quite a while under normal service. To cope with the rising impedance of the batteries as they age, each one has been shunted with a 100 $\mu$ F electrolytic capacitor.

At the time of writing, all components for the Millivoltmeter are readily available. However, a few comments on





**EA** AF MILLIVOLTMETER

71M1

Two Fet-input op amps make up this useful instrument. The second op amp is a voltage-to-current converter to drive the meter.

the more important items may be helpful. The meter used on the prototype was supplied by University Graham Instruments Pty Ltd. It is type TD-86. University Graham are also making a special scale available for the meter for this project and supplies of the meter and scale should be available from most components outlets. If you have any pro-

appears in print. If any difficulties are experienced obtaining these items, we suggest that you consult the list in the panel on the last page of the magazine, which gives names and addresses of suppliers of PCBs and Scotchcal panels.

The single-pole 10-position switch is available in a number of different makes and any one would be suitable. However, it is important that the switch be fitted with shorting-type contacts, otherwise the meter needle may swing violently when ranges are being switched.

### CONSTRUCTION

Construction may begin by assembling the components on the PC board. When assembling any PC board it is usually best to start with the small components, such as resistors and diodes and following up with increasingly larger items. Care should be taken to make sure that all soldered joints are properly made and that all components are correctly polarised where applicable. Overheating of components and the use of soldering pastes should be avoided.

It will be seen that there are two large copper pads on the PC board. These should be carefully tinned all over so that they will be prevented from possible tarnishing in the future and to ensure that good contact is made when the PC board is screwed to the meter terminals.

Having finished the PC board and having satisfied that it is all correct, it may be put aside for the time being. The next step is to fix the input divider resistors to

the range switch. A neat way of doing this is to mount the pairs of resistors radially to the switch. Care should be taken to make sure that the right resistors are fixed in each position, otherwise the final results will be found wanting!

If you have elected to use a meter other than one similar to that used on the prototype, then you may be interested in making use of the meter scale which we have reproduced actual size, provided it will fit the meter of your choice.

To give the unit a professional finish, the Scotchcal overlay on the front panel will help in this regard. Fitting Scotchcal overlays to panels can be very tricky and calls for care and patience. In short, do not rush this task. Once the adhesive has grabbed any part of the panel, it is difficult to remove and so it is important that they be properly aligned before the two are brought together.

A helpful hint for fixing a Scotchcal overlay to a panel, is to align the overlay on the panel before removing the backing and pierce one or more suitable holes in the overlay, thereby matching similar holes on the panel. Then when the backing material is removed, screws or other guides may be put through the holes in the overlay and they can then be used as a means of aligning the two parts before they are pressed together.

The shield which was mentioned earlier is essential to the proper operation of the unit, particularly at the more sensitive ranges. We used a piece of scrap aluminium sheet and cut it to size and screwed to the base of the box. If you are unable to obtain easily a suitable piece of metal, then a piece of aluminium foil could be used. It would be a good idea to stick it to a piece of Formica or similar laminate, to give the aluminium some support and to keep it in place. It should be done in such a way that a solder lug makes good contact with it under a screw, so that it can be ef-

### SPECIFICATION

A fully solid state AC millivoltmeter covering the audio frequency range and using two CA3140 Fet-input operational amplifiers. The unit is powered by two small 9V batteries, the current drain being about 5.5mA from each battery.

Nine ranges cover the FSD range 3mV to 30V RMS, with 10dB range ratios. The meter has three scales — a full length 0-10 scale, a 0-3 scale of slightly shorter length, and a decibel scale.

Frequently response of basic (3mV FSD) instrument is better than  $\pm 0.5$ dB from 5Hz to 30kHz. Minimum bandwidth on all ranges:  $\pm 0.5$ dB from 5Hz to 20kHz.

Input impedance:  $1M\Omega$  shunted by approximately 14pF on 3mV range, and approximately 7pF on all other ranges. Residual noise is equivalent to less than  $200\mu V$  RMS input, with input open circuited but shielded.

blems in obtaining one of these meters, we suggest that you contact Radio Despatch Service, 869 George Street, Sydney 2000.

The box which houses the unit is readily available from such places as Dick Smith Electronics, Rod Irving Electronics Radio Despatch Service and others. The printed circuit board and the Scotchcal front panel overlay should be available from the usual outlets by the time this

We estimate that the current cost of parts for this project is approximately

**\$38**

This includes sales tax.



## AC MILLIVOLTMETER

### PARTS LIST

- 1 Utility box 197mm x 113mm x 60mm
- 1 Meter 1mA FSD 86mm x 78mm with special scale. University TD-86-50 or similar
- 1 Miniature DPDT toggle switch
- 1 RCA socket single hole mounting
- 1 Scotchcal front panel
- 1 Rotary single-pole 10-position shorting type switch plus knob
- 1 shield plate 175mm x 90mm (see text)
- 1 clamp for batteries 60mm x 25mm
- 1 16mm tapped spacer for battery clamp
- 4 Rubber feet
- 1 Printed circuit board 95mm x 70mm code 80mv11
- 1 10k $\Omega$  miniature horizontal trimpot
- 1 1k $\Omega$  miniature horizontal trimpot
- 2 9V batteries type 216
- 2 clip leads to suit batteries
- 1 1N914 silicon small-signal diode
- 4 OA91 germanium small-signal diodes
- 2 CA3140 8-pin DIL op-amps
- 2 8-pin DIL sockets

#### RESISTORS ( $\frac{1}{4}$ W or $\frac{1}{2}$ W)

- 1 x 1M $\Omega$ , 1 x 10k $\Omega$ , 1 x 1k $\Omega$ , 1 x 330 $\Omega$ , 2 x 150 $\Omega$

#### RESISTORS (2% high stability)

- 1 x 680k $\Omega$ , 2 x 470k $\Omega$ , 2 x 150k $\Omega$ , 1 x 68k $\Omega$ , 2 x 47k $\Omega$ , 2 x 15k $\Omega$ , 2 x 4.7k $\Omega$ , 2 x 1.5k $\Omega$ , 1 x 1.2k $\Omega$ , 2 x 470 $\Omega$ , 1 x 120 $\Omega$

#### CAPACITORS

- 1 1000 $\mu$ F/12VW electrolytic
- 2 100 $\mu$ F/25VW electrolytics
- 2 0.1 $\mu$ F metallised polyester (greencap)

#### MISCELLANEOUS

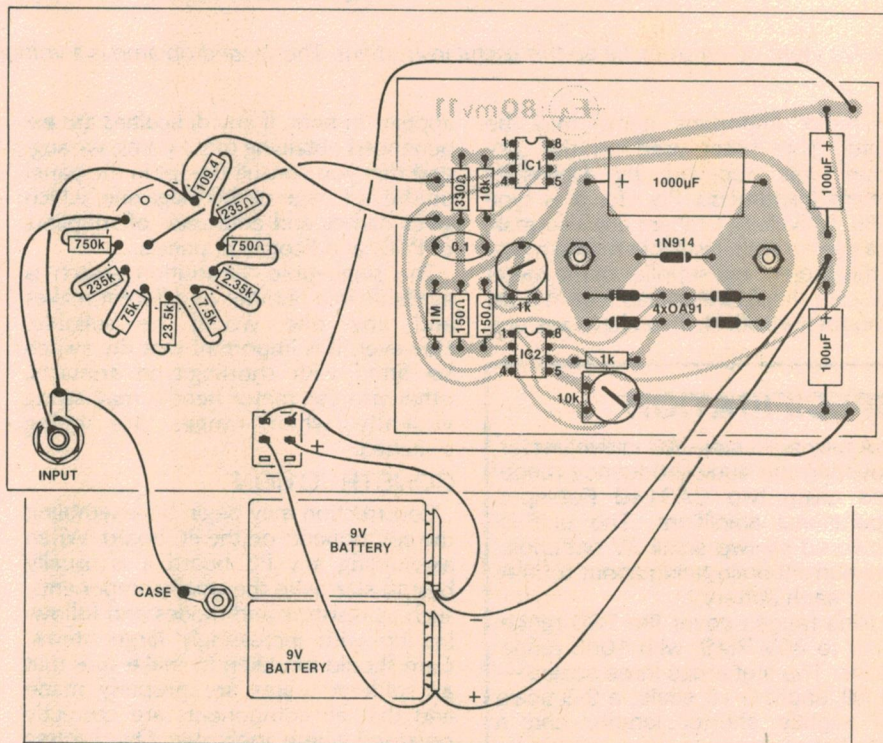
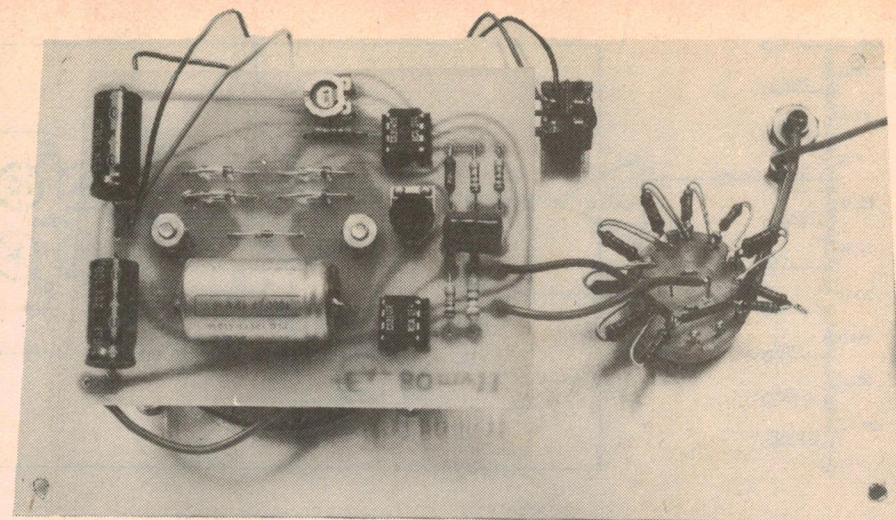
Screws, nuts, hookup wire, solder, solder lug.

NOTE: — Ratings are those used on the prototype. Components with higher ratings may generally be used providing they are physically compatible.

fectively connected to the "earthy" side of the main circuit.

With the subassemblies ready, the next job is to do the final assembly. The metal shield is screwed to the bottom of the box, using at least two screws. A solder lug is fixed under the screw nearest to the input socket end of the front panel. The two batteries may now be clamped in place on the bottom of the box, at the same end as the solder lug. We used a brass spacer, 16mm long and threaded, between the two batteries, with the top clamp plate being screwed to the spacer.

The toggle switch, input socket, range switch and meter are now fixed to the front panel. When mounting the range switch, it is important that it be orien-



tated so that when the knob is fitted, its pointer corresponds with the ranges on the panel.

The PC board is mounted directly on the back of the meter, using the meter screw terminals. But before doing this, all leads running from the PC board to points outside, should be fitted. These will include leads from the battery clips.

The remaining leads are terminated to the switches and input socket. The earthy lead from the board which terminates on the range switch is carried on to the corresponding lug on the input socket and then on to the lug on the bottom shield.

### CALIBRATION

We are now ready to put the millivoltmeter into operation, after having made a final check to be sure that there are no errors or omissions. Set the two miniature trimpots to mid-travel and

set the range switch to "short". Switch on and the meter needle will probably settle a little above zero on the scale. Carefully rotate the 10k trimpot to obtain a zero scale reading on the meter.

Calibration of the instrument should ideally be carried out by comparison with a reference instrument, using an audio generator set to approximately 1kHz at a level of 3.16mV, corresponding to FSD using the 3mV nominal sensitivity of the basic instrument. The 1k calibrating potentiometer is then adjusted to produce a reading of "10" on the 3mV range.

If a reference instrument of known accurate calibration is not available, a basic calibration will have to be performed using any available signal source having an amplitude known as accurately as possible. It would be preferable to have a level which gives as close as possible to a full scale reading, consistent with an



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### NEW WIRE-WRAPPING TOOL DOES ALL

The new WSU-30M "Hobby Wrap" tool performs the complete wire-wrapping function. First, the tool wraps 30 AWG (0.25mm) wire onto standard .025 inch (0.6mm) square DIP Socket Posts. In addition, the tool also unwraps and, finally, it strips 30 AWG wire nick-free.

## WSU-30M

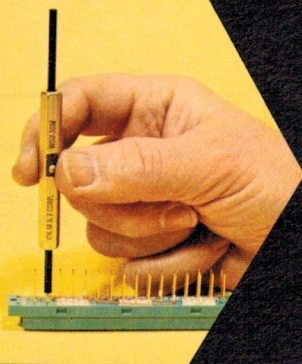
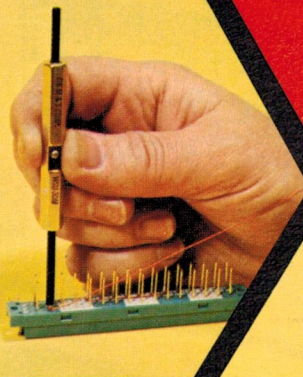
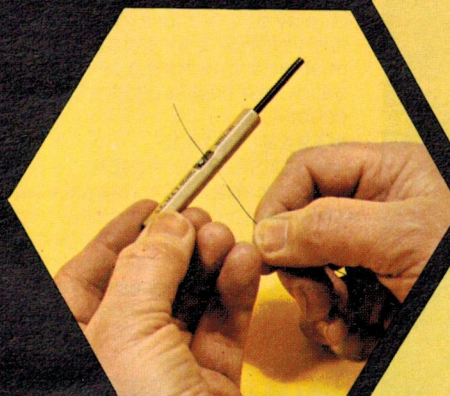
WSU-30M makes a "modified" style of wrap, in which approximately  $1\frac{1}{2}$  turns of insulated wire are wrapped in addition to the bare wire for purposes of added mechanical stability. Designed for the serious amateur, the WSU-30M features compact, all metal construction for years of dependable service. This unique tool is remarkable value performing the work of three separate tools at a fraction of the cost.



MODIFIED WRAP

PART No.  
**WSU-30M**

## Strip



## Unwrap



REGULAR WRAP

PART No.  
**WSU-30**

## Wrap

### WIRE WRAPPING-STRIPPING-UNWRAPPING TOOL

## WSU-30

The compact, inexpensive WSU-30 "Hobby Wrap" Tool does the job of three tools at a fraction of their comparable prices. The tool wraps, unwraps, and even strips wire thanks to a unique built-in stripping blade. Designed for use with 30 AWG (0.25mm) wire on standard .025 inch (0.6mm) DIP Socket Posts. Takes minutes to learn to use; makes perfect connections in seconds without solder.

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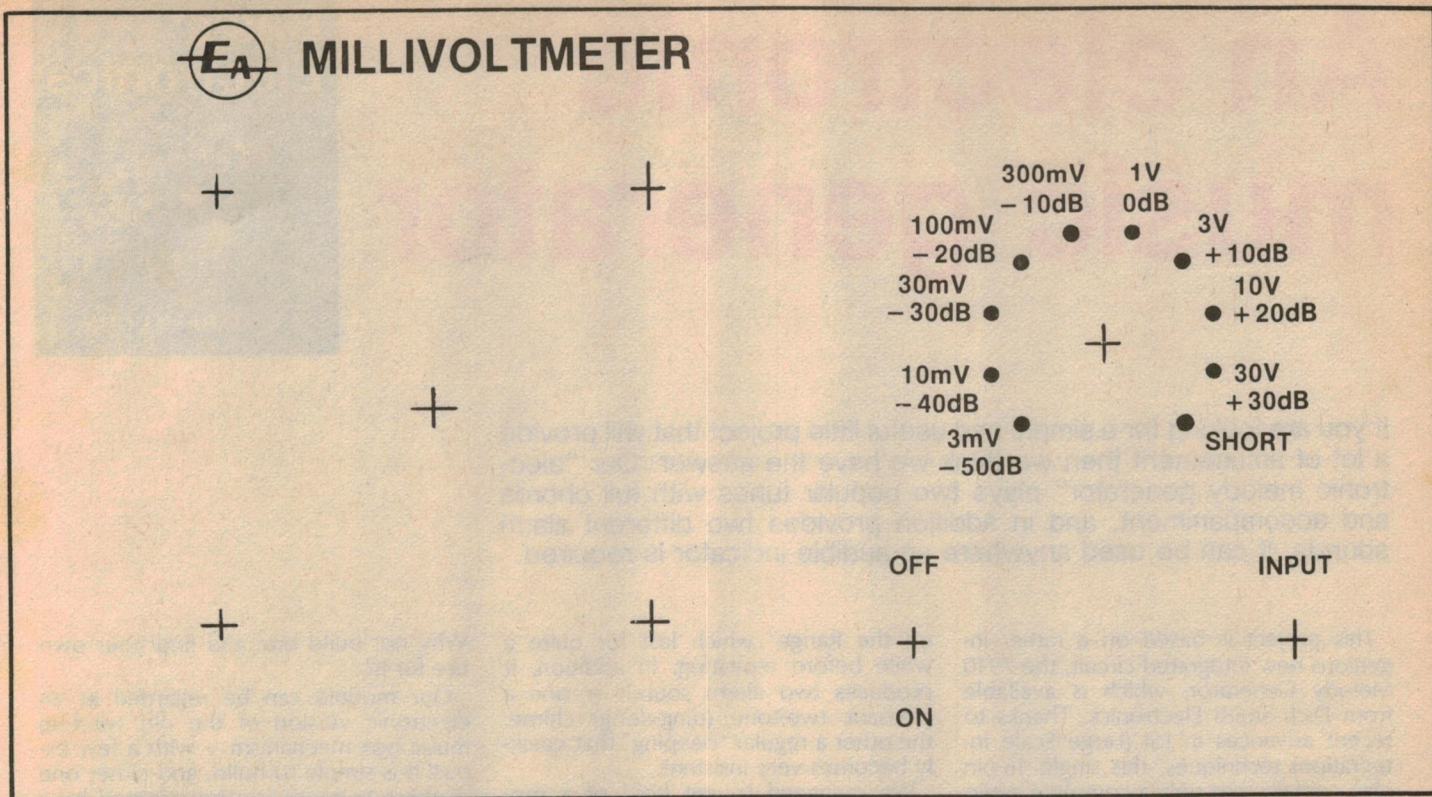
1 Wellington St, Rozelle, 2039. PO Box 132, Rozelle 2039. Ph (02) 818-1166.

Available from: **NSW** Radio Despatch Service, 211-0191. David Reid Electronics, 29-6601. Electronics (Distributors), 636-6052. Martin De Launay, 29-5834. Applied Technology, 487-2711. **VIC:** Stewart Electronics, 534-3733. Ellistronics, 602-3282. John Pearce, 528-5240. Ritronics, 489-8131. **QLD:** N.S. Electronics, 36-5061.

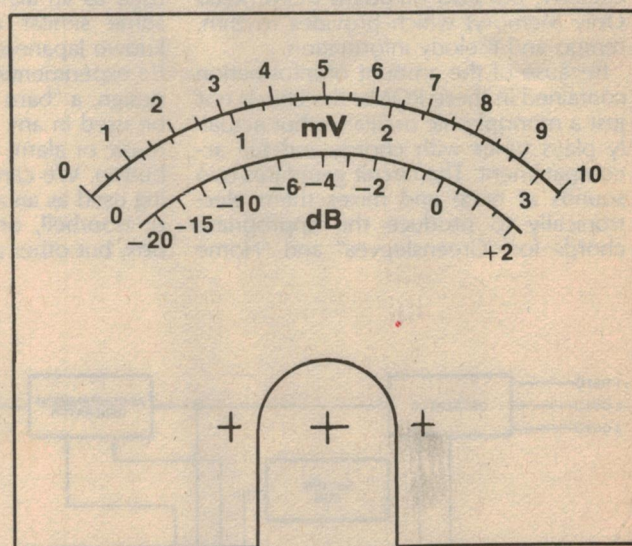
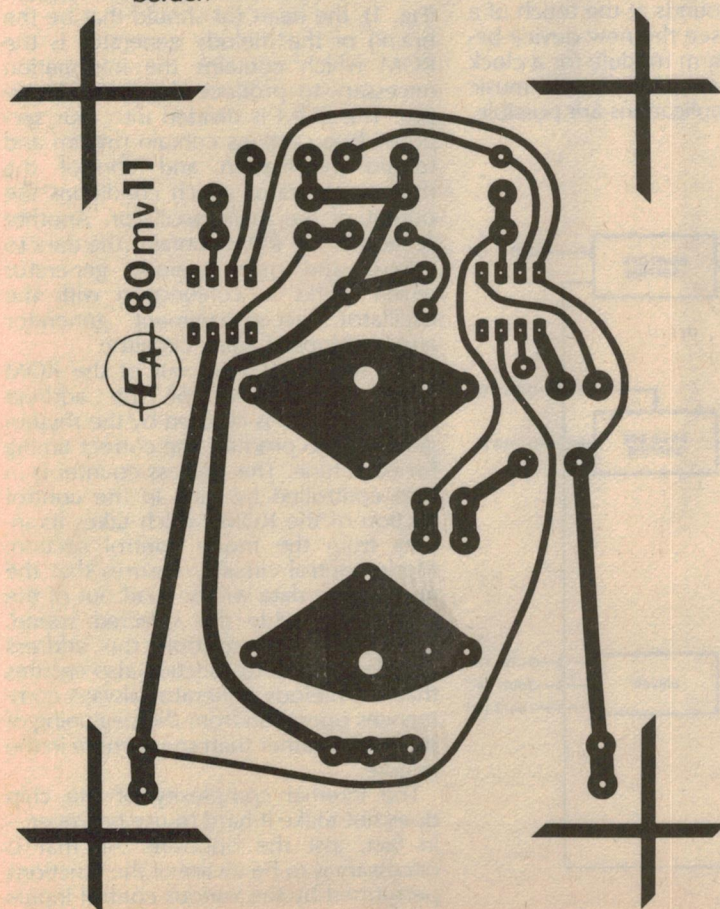
**WA:** Reserve Electronics, 275-2377. Taimac, 328-1988.



# MILLIVOLTMETER



Shown on this page is the actual size artwork for the printed circuit board, front panel and meter scales. The front panel should be cropped to 191 × 107mm to provide a border.



appropriate setting of the range switch.

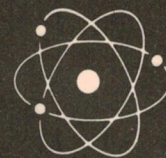
With the basic sensitivity set, all higher ranges will be determined by the voltage divider. As 2% high-stability resistors have been specified, the accuracy of each range should be within the tolerance of the resistors.

It should be noted that, in common with the majority of electronic meters, the instrument is fundamentally an average reading one which is calibrated in RMS values assuming a sinusoidal waveform. This fact should be taken into account particularly when performing initial calibration and it should also be borne in mind when subsequently using the instrument for measurements involving non-sinusoidal signals.



# An electronic music generator

Basic Electronics



by GERALD COHN

If you are looking for a simple and useful little project that will provide a lot of amusement then we think we have the answer. Our "electronic melody generator" plays two popular tunes with full chords and accompaniment, and in addition provides two different alarm sounds. It can be used anywhere an audible indicator is required.

This project is based on a rather ingenious new integrated circuit, the 7910 Melody Generator, which is available from Dick Smith Electronics. Thanks to recent advances in LSI (Large Scale Integration) techniques, this single 16-pin chip contains not only a complete audio tone generator and envelope shaping circuitry, but also on-board ROM (Read Only Memory) which provides rhythm, tempo and melody information.

Because of the amount of information contained in these ROMs, the chip is not just a monophonic oscillator, but actually plays tunes with chords and full accompaniment. The circuit generates two sounds at once and mixes them electronically to produce the appropriate chords for "Greensleeves" and "Home

on the Range" which last for quite a while before repeating. In addition, it produces two alarm sounds — one a pleasant two-tone (ding-dong) chime, the other a regular "beeping" that quickly becomes very insistent.

We managed to get hold of a prototype board which had obviously been used as an alarm module in a clock or some similar application, by a well-known Japanese watchmaker. After a little experimenting we came up with this design, a "bare bones" module that can be used in any application that requires music or alarm sounds at the touch of a button. We can see the new device being used as an alarm module for a clock or doorbell, or as an electronic music box, but other applications are possible.

Why not build one and find your own use for it?

Our module can be regarded as an electronic version of the old wind-up music box mechanism — with a few extras! It is simple to build, and either one of the two tunes can be selected by a simple switch. The two available alarm sounds can also be evoked by operating a switch, so the module is not limited to the classic music box application, but can be added to your favourite(?) alarm clock or used as a doorbell.

As can be seen from the block diagram (Fig. 1), the heart (or should that be the brain?) of the melody generator is the ROM which contains the information necessary to produce the musical output. The ROM is divided into four sections. Two sections contain rhythm and tempo information and control the rhythm generator which conditions the output of the main oscillator. Another section of the ROM contains the data to control the main melody generator which works in conjunction with the oscillator, accompaniment generator and envelope shaping circuitry.

The melody is read out of the ROM under the control of the address counter, which is clocked by the rhythm generator to produce the correct timing for each tune. The address counter is in turn controlled by data in the control section of the ROM, which takes its inputs from the mode control section. Mode control circuitry ensures that the appropriate data will be read out of the ROM to provide the selected sound. Because it also controls the address counter, the control section also ensures that the melody generator always commences operation from the beginning of each tune, rather than somewhere in the middle.

The internal complexity of the chip does not make it hard to use however — in fact, just the opposite. All that is necessary is to be aware of the functions performed by the various control inputs

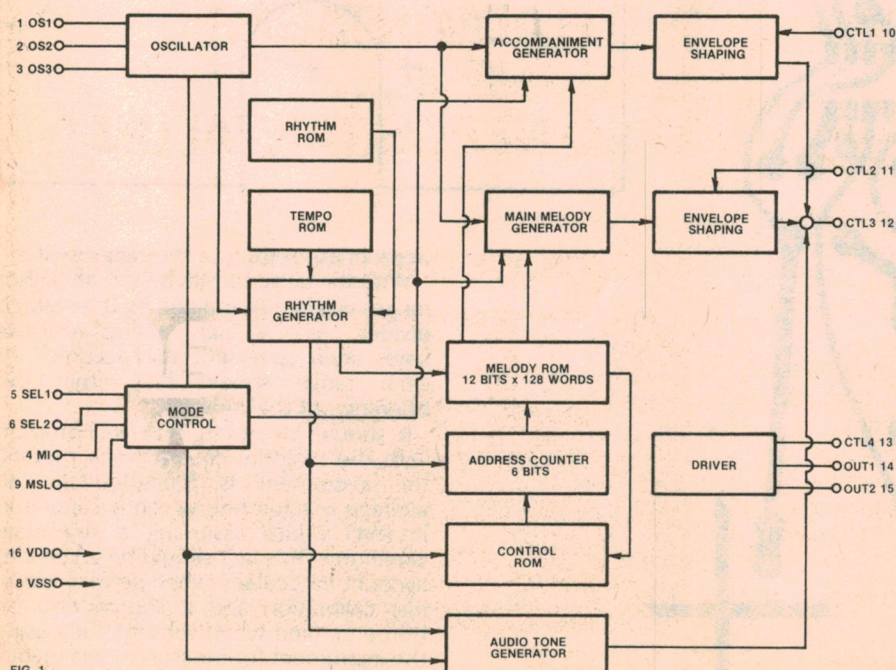
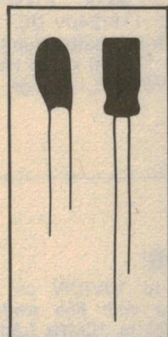


FIG. 1



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# SOANAR

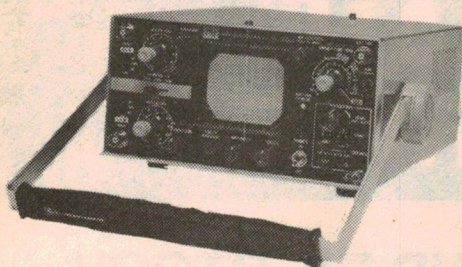
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# LOW COST PORTABLE OSCILLOSCOPES THAT DON'T COMPROMISE ON PERFORMANCE!



**TTM303**  
**15MHz**  
**Mains and Battery Operation**

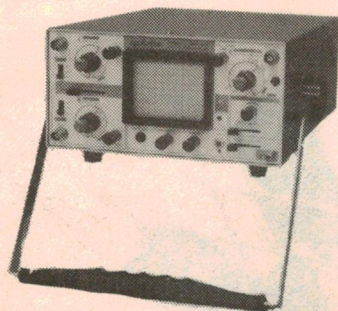
## TTM303

The TTM Dual Trace Portable Scope Model 303 offers a high sensitivity of 5mV/DIV with DC to 15MHz bandwidth. The 3-inch CRT with 1.5kV regulated accelerating voltage gives a clear bright display.

This Portable Scope operates from standard line voltage (90 to 260V) or from the internal rechargeable Ni-Cad battery, that provides 2 hrs operation before recharging is required. It also operates from any external DC voltages of 11 to 30V, e.g. car batteries, standard 'C' size cells, etc.

## SPECIFICATIONS:

SENSITIVITY:- 5mV to 10V/DIV 1-2-5 step with fine control. BANDWIDTH:- DC: DC to 15MHz (-3dB). RISETIME:- 24nS. OPERATING MODES:- CH-A, CH-B and Dual Trace TIME BASE:- 1µsec to 500 mS/DIV with fine control. EXPANSION:- x5 at all ranges. X-Y OPERATION:- X-Y mode is selected by SWEEP TIME/DIV switch. CH-A: Y axis. CH-B: X axis. POWER REQUIREMENTS:- AC: 115/240V DC: 11-30V, 7.2VA. Battery: Ni-Cad Battery (up to 2 hour operation). SIZE: 113 (H) x 223 (W) x 298 (D) mm approx. WEIGHT:- 4.5kgs.



**BS310S**  
**Mains and Battery Operation**  
**2mV Sensitivity**  
**Add/Subtract Feature**

## APPLICATION BS310S

The dual trace Model BS-310 employs a high brightness 95mm CRT and offers a high sensitivity of 2mV/DIV from DC to 15MHz.

The ADD/SUB feature makes this model ideal for measurement and maintenance of computers and peripherals. This scope is recommended for FLOATING Measurements and FREQUENCY/PHASE Measurement (X-Y mode). Rechargeable battery operation makes it ideal for repairing TVs and other consumer and industrial equipment.

**Now with 95mm  
rectangular  
tube**

## SPECIFICATIONS:

SENSITIVITY:- 2mV to 10V/DIV on 12 ranges in 1-2-5 step with fine control. BANDWIDTH:- DC: DC to 15MHz (-3dB). RISETIME:- 24nS. OPERATING MODES:- CH-A, CH-B, DUAL, ADD and CHOP. TIME BASE:- 0.5µsec to 0.5sec/DIV in 19 ranges and X-Y in 1-2-5 step with fine control. MAGNIFIER:- x5 at all ranges. X-Y OPERATION:- X-Y mode is selected by SWEEP TIME/DIV switch CH-A: Y axis. CH-B: X axis. POWER REQUIREMENTS:- AC: 115/240V DC: 11-30V, 7.2VA. Battery: Ni-Cad Battery (up to 2 hour operation). SIZE:- 113 (H) x 223 (W) x 298 (D)mm. WEIGHT:- 4.5kgs (5.5kgs including battery).



**BS610**  
**140mm**  
**No Parallax Display**

## APPLICATION BS610

The BS-610 employs a high brightness 140mm Rectangular CRT with internal graticule assuring easy and accurate observation of waveforms without any parallax.

External DC-Powered operation expands the versatility of this oscilloscope to FLOATING Measurements as well as field operation.

Other features including TV SYNC and HF REJ, make this scope ideal for research and development, production lines or in-the-field service applications from computers to electrical appliances.

## SPECIFICATIONS:

SENSITIVITY:- 5mV to 10V/DIV on 11 ranges in 1-2-5 step with fine control. BANDWIDTH:- DC: DC to 15MHz (-3dB). RISETIME:- 24nS. OPERATING MODES:- CH-A CH-B DUAL, ADD and CHOP. TIME BASE:- 0.5µsec to 0.5sec/DIV in 19 ranges and X-Y in 1-2-5 step with fine control. MAGNIFIER:- x5 at all ranges. X-Y OPERATION:- X-Y mode is selected by SWEEP TIME/DIV switch. CH-A: Y axis. CH-B: X axis. POWER REQUIREMENTS:- AC: 115/240V DC: 11-30V, 7.2VA. SIZE:- 145 (H) x 280 (W) x 369 (D)mm. WEIGHT:- 6.7kgs.

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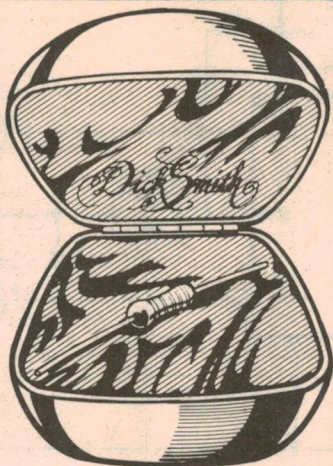
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actual output of the melody generator is quite loud this series resistor can be useful (particularly if you build up the circuit as an amusement for the kids!) The resistor can have any value up to about 5k. If you don't want to put the resistor in circuit place a wire link in its place when you assemble the PCB.

The transistor and the two resistors shown in the dotted box are also optional. They allow the device to be enabled by an active low signal, such as the alarm output of a clock. If this option is not fitted then a switch from pin 4 to the positive supply rail as shown in the circuit diagram, will enable the chip.

The other point that needs to be mentioned at this stage is that provision has been made on the printed circuit board for the four switches shown on the circuit diagram to be mounted in the form of a four way DIL switch. Use of this approach will depend on your budget and the application you have in mind for the unit.

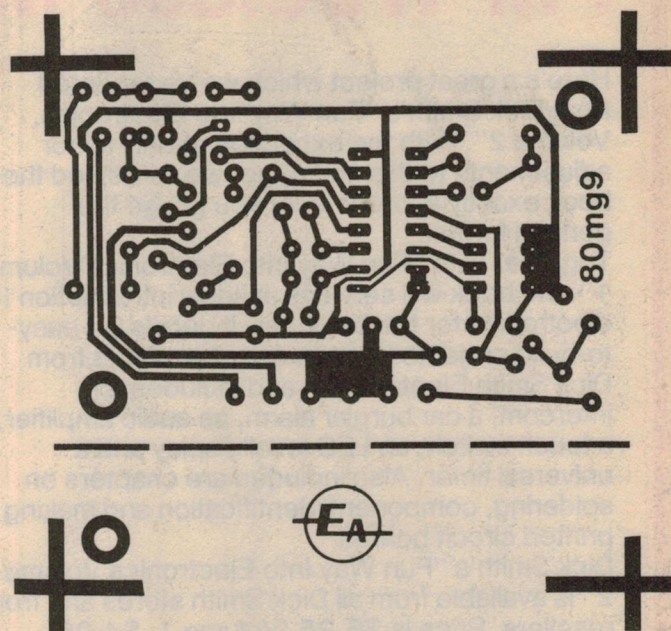
Now let's take a look at the assembly of the printed circuit board. The PCB measures 68 × 74mm and is coded 80mg9. All the components including the battery can be mounted on the PC board. Mounting the battery on the PCB is optional however, and the area provided for this can be cut away if not required. A cutting line is etched on the PC board for this purpose.

Assembly of the circuit is a simple matter. Start by placing the resistors and capacitors on the PCB, not forgetting to make sure that the polarised capacitors, four in all, are properly orientated. Next solder the wire links in place, and then the two transistors (or three if an active low enable is required). The IC should not be soldered to the PC board for several reasons, the most important of which is the cost – approximately \$7. The other reason is that the IC is a CMOS type which can be damaged by static electricity. A socket should be used here.

Before placing the chip in the socket check that all components have been placed properly according to the component overlay diagram. If there are no mistakes plug the IC into the socket and place the battery into the holder. If you now enable the circuit as described earlier you will hear the tune "Home on the Range". "Greensleeves" is enabled by taking pin 9 high.

The alarm tones are enabled by taking each of the select inputs (SEL1 and SEL2) high in turn, remembering that nothing can happen until the enable input (MI) is also taken high. If both of the select inputs are taken high at the same time you will hear the selected tune at eight times the normal speed, as mentioned earlier.

At right is an actual size reproduction of the PC artwork. Board size is 68 × 74mm.



FUNCTION	MI	MSL	SEL1	SEL2
DISABLED	0	X	X	X
MELODY 1	1	0	0	0
MELODY 2	1	1	0	0
ALARM 1	1	0	1	0
ALARM 2	1	0	0	1
TEST MODE	1	X	1	1

1 = LOGICAL HIGH  
0 = LOGICAL LOW  
X = DONT CARE

FIG. 2

We estimate that the current cost of parts for this project is approximately

**\$12.00**

This includes sales tax.

We have set out the functions of the various select and control inputs in the form of a truth table (Fig. 2) which should help in selecting the desired mode of operation.

If you are one of the many readers who built the desk-top version of the clock featured in the April 1980 issue then you can use the music module as the alarm. The transistor and two resistors shown as optional are not required. Simply add the alarm set buttons to the clock and wire the alarm output from the clock module to the hole provided for the col-

## PARTS LIST

1 Printed circuit board 68 × 74mm (80mg9)  
1 7910 melody generator IC  
1 miniature 8-ohm loudspeaker  
1 4 way DIL switch (see text)  
1 BC558 PNP transistor (see text)  
1 BC559 PNP transistor  
1 BC549 NPN transistor

RESISTORS (¼ or ½W, 5% tolerance)  
1 × 560k, 5 × 120k, 2 × 10k, 1 × 4.7k  
1 × 50k vertical mounting miniature trimpot

CAPACITORS  
1 × 56pF ceramic NPO  
2 × 100pF ceramic  
1 × .001uF metallised polyester (greencap)  
1 × .015 greencap  
1 × 0.1uF greencap  
2 × 4.7uF/10VW electrolytic (PC mounting)  
1 × 10uF/16VW tantalum electrolytic  
1 × 33uF/10VW electrolytic (PC mounting)

MISCELLANEOUS  
Battery holder and battery to suit (1.5V penlite cell), solder, hookup wire etc.

lector lead of the optional transistor. The clock and the music module can be run from the same battery.

Or how about a doorbell that plays "Greensleeves" for the front door and "Home on the Range" for the back door. And that still leaves those two alarm sounds!

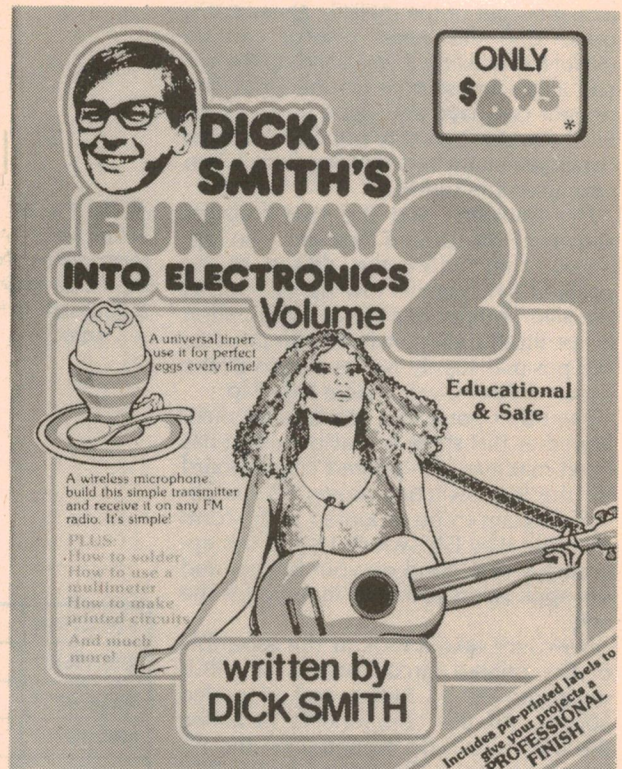


# FM Wireless Microphone

Here's a great project which we've reprinted from Dick Smith's "Fun Way Into Electronics, Volume 2". With the exception of only minor adjustments to this first page, we've copied the book exactly in order to let you gauge the general format.

Together with "Fun Way Into Electronics Volume 1", the book will serve as an ideal introduction to electronics for the beginner. It details 20 easy-to-build projects (the kits are all available from Dick Smith Electronics), and includes an intercom, a car burglar alarm, an audio amplifier, a touch switch, an LED level display and a universal timer. Also included are chapters on soldering, component identification and making printed circuit boards.

Dick Smith's "Fun Way Into Electronics Volume 2" is available from all Dick Smith stores and from resellers. Price is \$6.95 (Volume 1, \$4.95). Now for the FM wireless microphone. . . .



## You will need these components

### Resistors:

- R1 22k ohms
- R2 47k ohms
- R3 10k ohms
- R4 100 ohms

### Capacitors:

- C1 2.2uF 10 volt electrolytic
- C2 470pF ceramic
- C3 470pF ceramic
- C4 3.3pF ceramic
- CT1 6 to 20pF trimmer capacitor

### Semiconductors:

- TR1 DS548 or similar NPN transistor

### Miscellaneous:

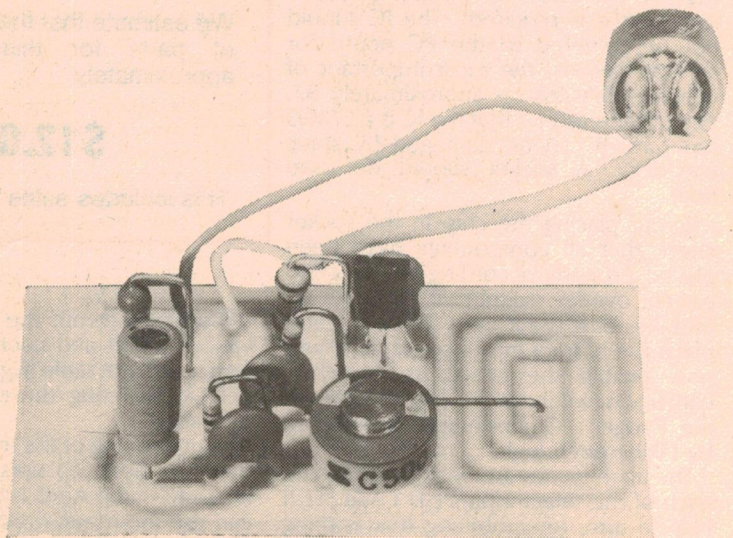
Electret microphone insert  
Battery snap, solder, hook-up wire, a few cm of tinned copper or hook-up wire for the antenna (see text)

You will also require a 9 volt transistor battery (not normally supplied with a kit) or some other 9 volt DC power supply.

A suitable mounting board or printed circuit board of correct design (DSFW2 K-2631 **Wireless Microphone** kit contains the correct PCB.)

Ever wondered how concert performers move around the stage without a microphone lead? Simple: they use a microphone with a tiny transmitter built in! Here's one you can build in an hour or so — all you need to receive it is a standard 88–108MHz FM band receiver.

And you can make a tiny version to use as an electronic "bug": James Bond, move over!





## putting it together

- (1) If you have purchased a kit (Dick Smith Cat. K-2631 or similar), check off the components against the above list to make sure they are all there and are the correct types and values.
- (2) If you have not purchased a kit you will need to obtain the components listed and either make a printed circuit board using the component position drawing as a guide, or use a perforated or tracked board.
- (3) Mount the components as shown in the component position drawing. Place and solder the resistors and capacitors first. Note in particular how the resistors are mounted to save space. Take extra care to ensure that C1 is the right polarity. The negative side goes to one side of the microphone insert. Check that all components are neatly placed and properly 'dressed' before soldering them in.
- (4) Solder the trimmer capacitor, CT1, in place. You shouldn't make any mistakes here, as it has to be forced in to get it in the wrong way!
- (5) Now connect and solder the electret microphone insert with the red lead to the positive track, the white lead to the negative side of C1 and the shield to the negative track. Solder in the wire link that connects the centre of the coil to the positive track.
- (6) Solder in TR1 the DS548 NPN transistor, noting that it is the right number first and that you place it so that the collector goes to the coil etched onto the PCB. Use a heatsink clip when you solder to prevent damage to the transistor from overheating.
- (7) Solder in a short length of wire for the antenna to the position shown on the PCB. This can be virtually any wire, a short length of insulated hook-up wire is ideal (say about 20cm or so). Or you can make it a similar length of stiff tinned copper wire, so that the antenna remains rigid. (Make sure the wire cannot short circuit onto any other components or tracks on the PCB).
- (8) Connect and solder the battery snap with the red (positive) lead going to the pad marked '+' and

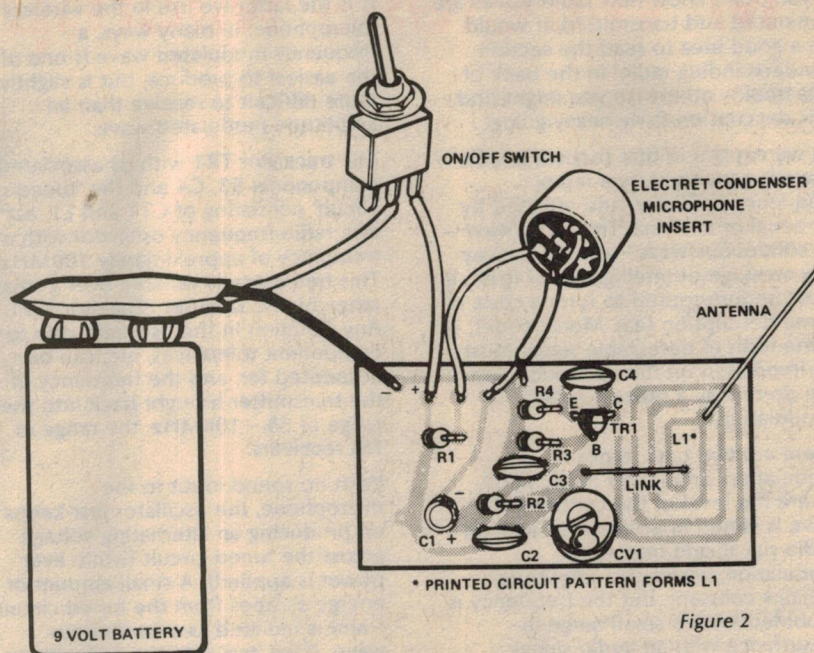


Figure 2

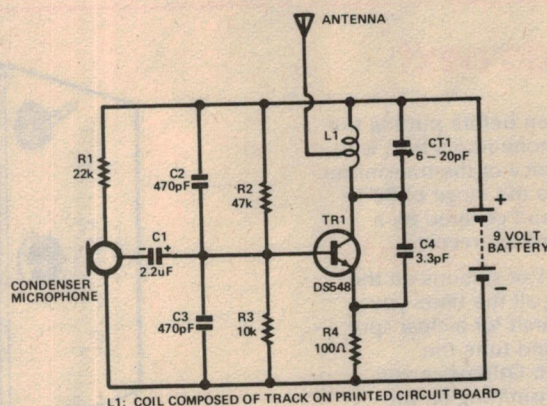


Figure 3

the black (negative) lead going to the pad marked '-'. If you want to add a power switch and/or socket for external power, these can be added now too: follow the diagrams for correct connections.

- (9) Before you connect the battery check again that all of the components are in the right place, are correctly oriented and soldered in properly. Clip off all excess leads carefully.
- (10) Connect the battery and switch the transmitter on. If you tune a nearby FM receiver over its band, you should hear it go very quiet in one (and possibly more) tuning positions. Talk into the

microphone and you should hear yourself coming from the receiver. If not, try re-tuning the receiver, and/or adjusting the trimming capacitor, CT1, until you hear yourself.

See 'What to do next' for more tuning details and other ideas to try.



## how it works

If you don't know how radio waves are generated and transmitted, it would be a good idea to read the section 'Understanding radio' in the back of this book – otherwise you might find this description fairly heavy going!

As we explain in that section, a radio wave is generated by a radio frequency oscillator, and radiated by an aerial or antenna. This radio wave – or continuous wave – cannot convey any message or intelligence of itself: it must be interrupted to form a code of some description (e.g. Morse code); or some form of detectable signal must be impressed on the continuous wave. We do this by a process called 'modulation'.

There are two basic types of modulation: amplitude modulation, where the level of the continuous wave is varied in accordance with an audio signal; and frequency modulation, where the amplitude remains constant, but the frequency is 'wobbled' over a small range in accordance with an audio signal.

It is the latter we use in the wireless microphone: in many ways, a frequency modulated wave is one of the easiest to produce, but is slightly more difficult to receive than an amplitude modulated wave.

The transistor TR1 with its associated components R3, C4 and the 'tuned circuit' consisting of CT1 and L1, act as a radio frequency oscillator with a frequency of approximately 100MHz. This frequency is variable over a small range by the trimmer capacitor, CT1. Any variation in the oscillator due to component tolerances, etc, can be accounted for, and the frequency of the transmitter brought back into the range of 88 – 108MHz, the range of FM receivers.

With no sound input to the microphone, the oscillator just keeps on producing an alternating voltage across the tuned circuit (while ever power is applied). A small amount of energy escapes from the tuned circuit – and is radiated as a continuous wave. If we 'tap' into the coil with an aerial of some sort, significantly more

signal is radiated.

If we wished, we could use the circuit in this basic form with a Morse key to produce a 100MHz continuous wave Morse code transmitter.

But we want to transmit voice! To do this we use a microphone, which produces a small voltage when it receives sound waves. This voltage, which is varying with the sound input, is applied to the base of TR1 via C1. While the voltage is small, it is enough to upset the balance of the circuit created by C2, C3, R1 and R2 – and cause the frequency of the oscillator to vary. The frequency variations occur as the voltage varies; and obviously if the voltage is varying in sympathy with the sound input to the microphone, the frequency variation of the oscillator must contain the original sound patterns.

So the frequency variations produced by the oscillator are a reproduction of the sound received – in other words, the frequency is being 'modulated' by the input voltage. Hence the name: frequency modulation.

## what to do next

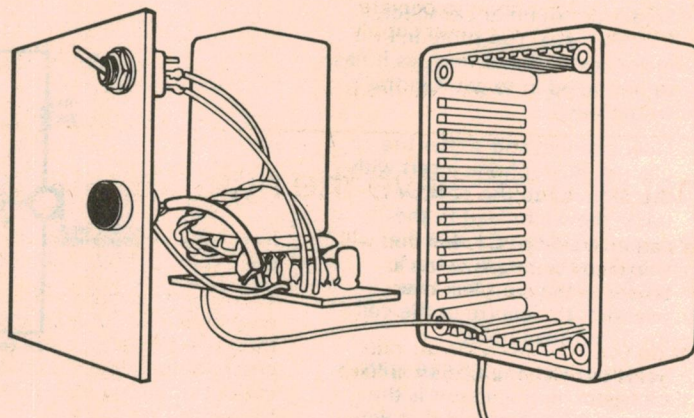
The first step, even before putting the Wireless Microphone into a box, is to adjust the frequency of the transmitter so that it falls into the range of 88 to 108MHz – the band covered by a standard FM broadcast receiver.

With the numbers of stations on the FM band growing all the time, you might have to search for a clear spot on the dial first, and tune the transmitter to that. Otherwise you might end up transmitting on the same frequency as a 50,000 watt FM station – and we know which transmitter would win that little battle!

As you are probably aware, the transmitter's frequency is controlled by a 'tuned circuit', which consists of a coil and a capacitor. Varying either of these components varies the 'resonant frequency' of the tuned circuit, and thus the transmitter's frequency. Because the coil in this project is actually an etched track on the printed circuit board (and therefore a little difficult to change!), we have included a variable capacitor to adjust the frequency.

Tune your FM receiver to a relatively free spot on the dial, and turn on the wireless microphone transmitter. Slowly adjust the variable capacitor over its entire range, and you should hear the receiver go quiet at one point. You might also hear a

Figure 4



'wooshing' sound as you tune onto this point. Or, if your microphone is too close to the receiver's speaker, you might get acoustic feedback between the two, resulting in a howl or squeal from the speaker.

Once the transmitter is tuned in, you might like to mark the frequency (as read from the receiver dial) in the space provided on the front panel. This is so you don't have to go through the tuning procedure again: any FM receiver set to that frequency should operate in the same way.

### Fitting it into a box

The PCB slots in sideways into the 'baby' Zippy box, with enough room left over for the battery, switch and microphone. This makes the whole transmitter fairly small.

There is nothing to stop you lengthening the wires from the microphone insert to the PCB, if you want to use the microphone external to the box. However, make sure you use shielded wire, as shown in the layout diagram, for the audio connections to the microphone.

### The 'antenna'

A short length of wire attached to the coil will radiate enough signal for close range operation, but for longer ranges, the antenna can be made more efficient. An antenna is simply a device designed to 'lose' energy (in the form of radio waves). A good antenna simply loses more energy!

While you can use a random length of wire (even a piece of tinned copper wire a few centimetres long will do),



## what to do next . . . continued

the transmitter will perform better with a longer antenna. It will perform even better if you add a second piece of wire to the pcb to form what is known as a 'dipole' antenna. This second piece of wire is soldered to the pcb in the hole provided diagonally opposite to the aerial connection shown on the pcb component overlay.

You will get maximum radiation if both lengths of wire are approximately 75cm long; however, this can be a bit unwieldy! You can compromise on length without too great a loss of signal by simply making both halves of the dipole a convenient (but identical) length.

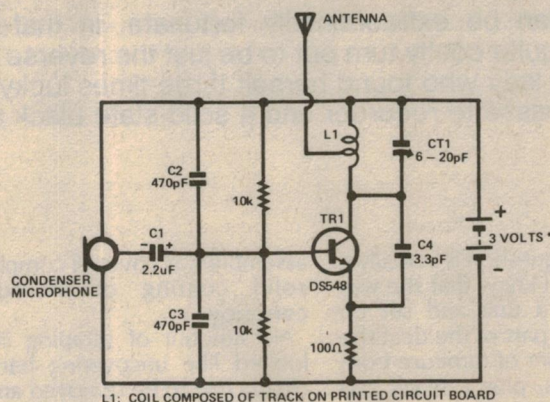
### Making a miniature 'bug'

This circuit can easily be modified to operate from a lower voltage, making it suitable for use with silver oxide or other very small batteries. Thus the whole transmitter can be made very small and inconspicuous – an ideal 'bug'!

All that is needed for low voltage operation (say around three volts or so) is to replace R1 by a wire link, and change R2 to 10k. This allows the transistor and microphone to operate more efficiently with the lower supply voltage.

Connections to these small batteries is

a bit of a problem (as discussed in project one). You might be able to make a simple battery holder as we did for the electronic jewellery, or come up with another idea for a suitable battery holder. As we mentioned in project one, these batteries **do not** like being heated: so don't try to solder to them. They might explode!



## what if I don't have the right transistor? . . .

Here's an interesting question you will almost certainly want answered at some time during your electronics experiments:

**'What do you do when a circuit calls for an NPN transistor, and all you have is a PNP type?'**

In many cases, there is a very simple solution. In others, however, it is a case of 'tough luck!' Let's take a specific example:

Suppose you wanted to build the FM transmitter as described over the last few pages, and you had all the components excepting the DS548 transistor. On looking through your 'junk box', however, you find you've a DS558 transistor: the PNP equivalent of a DS548. Here's what you do:

Put in the DS558 in exactly the same position as the DS548. Then, reverse the connections to the battery and all polarised components in the circuit.

In the case of the FM microphone, this would mean reversing only C1, the 2.2uF capacitor, and the condenser microphone insert (the red

lead is swapped with the shield, while the white lead is left where it is).

The FM microphone is a particularly easy case: but if there were such things as diodes or other polarised components (don't forget tantalum capacitors are polarised), all would have to be reversed.

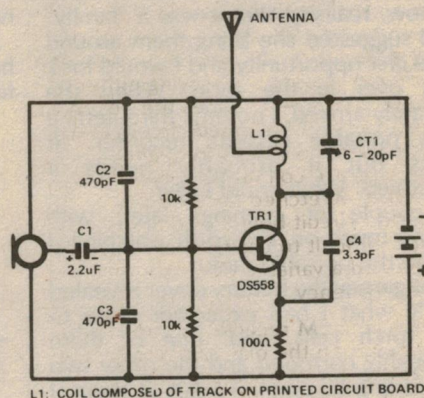
If there were other transistors in the circuit, obviously **all** of them would have to be replaced with the opposite types: you can't replace one and not the others!

What if the circuit contains integrated circuits, or a mixture of integrated circuits and transistors?

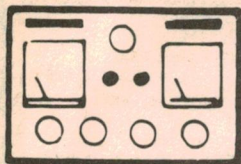
You're probably out of luck! Unless you know the particular characteristics of an IC and know exactly what, and how it works in the circuit, you cannot change their connections around and expect them to work. In all probability, you'll blow the integrated circuit up if you change its connections!

So remember: **If the circuit only contains transistors, they can normally be replaced with opposite polarity types if you also reverse all other polarised components.**

**If the circuit contains integrated circuits as well, you cannot normally make substitutions.**







# The Serviceman

## Battery powered equipment is fine — except that . . .

Some people can be extraordinarily fortunate, in that problems which could be quite costly turn out to be just the reverse. Take the case of a young lady who found herself three-times lucky — with a portable radio, cassette recorder and a solid-state black and white TV receiver.

The young lady in question is actually a relative of mine and I knew that she was negotiating to buy a unit and set up home for herself. As part of the deal she inherited a fair amount of furniture from the previous owners, plus a black and white television set.

I became more directly involved when she rang to ask whether I would look over her portable radio, which had been unused for several years. She said:

"The batteries are flat and I can't get them out!"

One didn't need to be a genius to guess why: The batteries would almost certainly have leaked during the period of idleness and "goosed" themselves in! How much additional damage they had done remained to be seen.

"And please, could you have a look at the TV set? It has sound but no picture. The people said that there couldn't be much wrong with it!"

How many times have I heard that one? The average person just wouldn't know. Anyhow, realising that it was a "family" job, I suggested she bring them around at the first opportunity and I would look them over in the shop. When she ultimately arrived, I noted a third item, a Sharp portable cassette recorder: "It works but it probably needs a checkover!" What could I say?

A couple of evenings later, with nothing much on TV worth watching, I tackled the portable radio.

Sliding open the battery cover revealed exactly what I had expected: three C-type torch cells, with one of them thoroughly corroded and the other two just starting to ooze. To get at them, I had to remove the back altogether and prize them out. With them came what was left of the battery instructions, the lift-out tape and sundry bits of cardboard, etc. The half-tubular battery support was intact but the positive contact

assembly was covered completely with a solid coating of incredibly hard corrosion.

No amount of scraping in situ even looked like uncovering bare metal. It clearly had to be removed and replaced. But the screws which held it in position were rusted solid and there was every chance that they would break off and leave me with no way of mounting a replacement contact. So I sprayed them with WD-40 and turned my attention to the rest of the works.

Very fortunately for my young relative, the corrosion had started to creep but hadn't penetrated too far and a bit of treatment with WD-40, a brush and a rag managed to clean most of it up.

And then, to my great relief, the screws holding the corroded battery contact yielded before they broke and I was able to get it free. I made up another one from scrap brass sheet, put it in place, installed new batteries and we were in business. The portable behaved as normal.

But this I must say: If the young owner had left the set lying around for only a few more months, the story might well

have been quite different. If the goo had got into the coils and on to the speaker cone, a certain dual-wave National portable receiver would have been suitable only for the scrap heap!

As it was: it needed only a half-hour's work and a small piece of springy brass to put it back in service.

The Sharp cassette player turned out to be well on its way towards a similar fate. It had not been used much recently, and then only with an external 6V mains power pack. Why buy batteries if you don't have to?

In fact, the batteries were still in there, dead flat and starting to ooze. More to the point, some of the ooze had reached the positive contact lug and it had literally reduced it to an outcrop of "rust".

## MORE "MICROSURGERY"

Once again, I had to embark on a course of mechanical microsurgery, fishing out the tiny holding screws and fashioning a replacement contact from scrap brass. Everything else worked okay, especially after I had cleaned the heads with a head cleaner cassette.

But I resolved to advise her not to fit batteries to the recorder unless she knew she was going to need them. The chances are that they, too, would be forgotten!

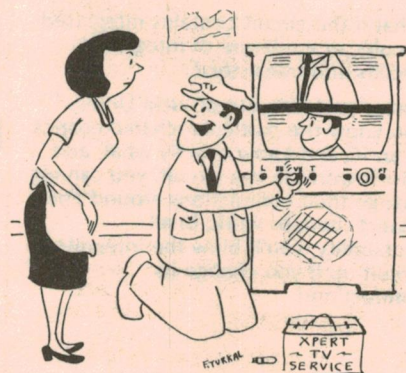
Why do I dwell on this elementary problem? Mainly as a reminder to all who read this, that batteries must be removed from equipment during long periods of disuse. I know well that batteries are supposed to be "leak-proof" but don't kid yourself. Leaving them in is like playing Russian roulette: one in six is likely to go off!

Nor is the problem confined to members of the public. Servicemen, technicians, radio amateurs and so on are using more and more instruments powered from internal batteries. The ones you are using all the time are not the worry. The ones that catch you are those that sit on a shelf forgotten for months on end.

I know; I've been caught too!

Well, now for the TV set with "nothing much wrong".

One glance was sufficient to indicate



"Now you pick the best picture, Ma'am, and I'll stop it on that one!"



that it was a 23-inch transistorised AWA/Thorn model of fairly recent vintage. If it had "blown" something in the line output, or EHT system, or video system (any or all), or if the tube had had the claw, the set might turn out to be not much of a bargain. As I have remarked before, a monochrome TV set can cost more to fix than it is worth in the marketplace.

Anyway, I whipped off the back, to be confronted by a copy of the circuit taped inside. On it, someone had marked a couple of alternative types of line output transistor. Fairly obviously, this wasn't the first time the set had broken down.

Anyway, I switched it on and was greeted by clear sound, even before any kind of antenna was attached. Pretty obviously, the tuner and IF systems were operating normally, with gain to spare.

And I could see the picture tube heater glowing, which was another good sign.

What about the EHT? I had an immediate and partial answer because, in reaching around the front of the set, I felt the hairs on my arm bristle perceptibly. But I needed to be reassured.

Switching off, I unplugged the ultor lead and then switched on again. I could hear a faint corona and, when an earthed screwdriver was brought near the ultor cap, a healthy sizzling arc leapt between them.

Lucky for the owner, that was okay too!

With the EHT lead restored, I reached for the CRO and touched the lead on to the picture tube cathode. No doubt there, either: a solid video signal was present, which varied as I manipulated the preset contrast pot. That left the brightness circuit as the most likely culprit.

Here I had to spend a bit of time studying the circuit, which would have been rather difficult but for my grandfather style reading glass, which lives at the back of the bench. Thank goodness, the printing on the swing-out circuit board was of a much higher standard and I was able to locate the appropriate points and resistors.

## SIMPLE FAULT

There was a positive voltage on the cathode but none on the grids, indicating clearly that the beam current was well and truly cut off. Tracing back, I came to a 390k which should have had 470V on one end (according to the circuit) and 720V on the other — the full boost supply. It had the 720V okay but not the 470V. Either the resistor was open or the bias circuit was shorted to ground.

Guessing at the former, I spotted a replacement resistor across the solder points and up came the picture. It was but a few minutes work to swing back the board and effect a proper replacement — and the job was done. Everything about the set seemed fine: a few minutes work and a 5c resistor. My young relative had been twice lucky!

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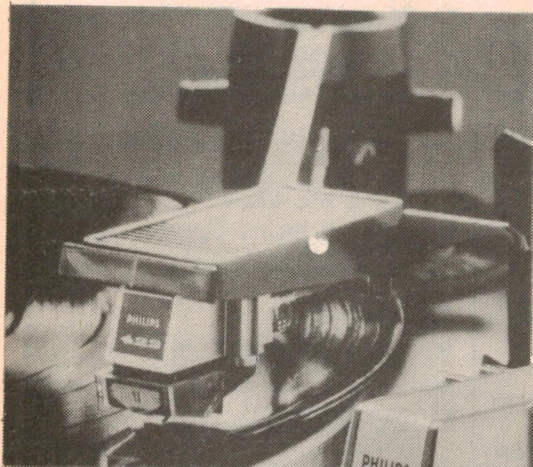
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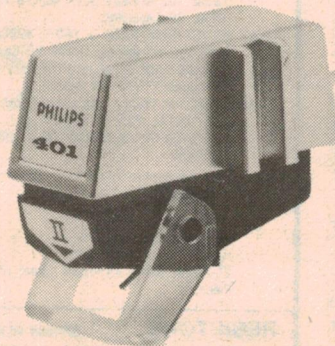
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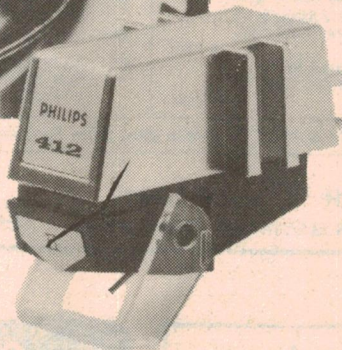
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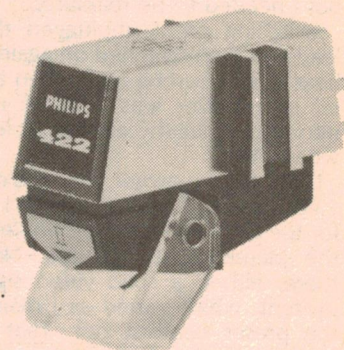
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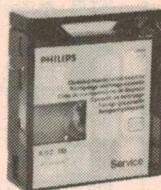
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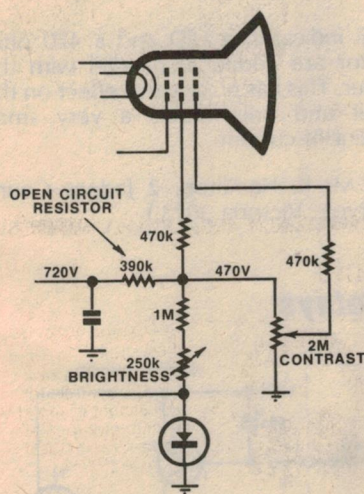
But one thing did intrigue me: the resistor which had been the cause of the trouble was a tiny component that I took to be a quarter-watt type — not too far above the wattage load and with a nominal 250V across it. Maybe the manufacturer knows more about resistors than I do but I would have expected it to break down — and break down it did!

I can assure you that the one I substituted for it was a much more substantial component.

And there the story might have ended (leastwise the episode) had I not left the set running while I did a bit of cleaning up around the workbench.

Suddenly I noticed the set flip a frame, then another and another. Puzzled, I readjusted the vertical hold and went on cleaning up. A minute or so later, the picture started to roll continuously, and then to tear horizontally. I realised that something was definitely wrong, especially when my efforts with the hold controls on the rear of the set suggested a complete lack of sync pulse. Then suddenly, everything was back to normal.

Please: not an intermittent!



An otherwise modern monochrome TV set could easily have been scrapped because of one small, overloaded resistor.

With a sigh of resignation, I took the back off the set and, with a mirror propped so that I could watch the screen, I started tapping around the large vertically mounted PC board. Yes, it did seem to be vaguely tap-sensitive but not enough to give me any kind of a lead.

As I looked at the amount of circuitry involved in the video, sync separator and oscillator circuits, and the way it was spread around the board, I felt not the slightest urge to start chasing an intermittent in that lot! Anyway, the picture had reverted to normal.

A few minutes later, the set played up again but, this time, instead of rolling or

tearing, the picture outlines became all fuzzy, as if the line oscillator itself was intermittent; as if the flywheel circuit was not working properly, allowing the line oscillator to trigger on noise affected sync pulses.

And then the penny (sorry, cent) dropped!

I leaned down to put my ear very close to the EHT cage and, in the act, heard two suspicious sounds: a very faint arcing noise from the cage and a very faint rustle from the loudspeaker. It strongly suggested a partial breakdown in the EHT circuitry, producing both video and audio interference.

Swinging the PC board out, I removed the fibreboard cover from the EHT components and tried the receiver again, with the workshop lights off. And there, in the darkness, I could see a tell-tale glow illuminating one end of the EHT rectifier stick.

I tried to ease it out of its shrouded connector, but there was no way that it was going to pull free in one piece. So I pulled it out anyway, complete with charcoal dust. Then, with pliers and tweezers, I had to fish out the remains of the metal cap and the remains of the spring connector. That meant yet another exercise in mechanical microsurgery to fashion a replacement clip for the one that had been spark eroded away.

That done, I plugged in a replacement rectifier stick — fortunately not an expensive item — and everything returned to normal.

How come?

There never was anything wrong with the sync or oscillator circuits. What apparently happens, in a case like this, is that the arcing occurs at line frequency, doubtless on each input voltage peak. In so doing, it creates an interference pulse which affects the triggering of the line oscillator. But, because it is an arcing effect, its timing is random, and so is its effect on the line oscillator; hence the line-by-line shimmer.

That much is fairly easy to understand. What is not so obvious is how it can cause rolling and tearing, at times, without an obvious shimmer. Perhaps it drifts through a timing coincidence which happens to cancel the proper sync pulse or disable the sync separator. All I know is that replacing the rectifier fixed the entire problem and that the set has been working fine ever since.

Lucky girl . . . three times lucky girl!

If you have a factual and interesting story to tell about electronic servicing, write it in your own words and send it to "The Serviceman", c/- "Electronics Australia", Box 163, Beaconsfield 2014. If the Serviceman uses it in his column, we will pay an appropriate fee.

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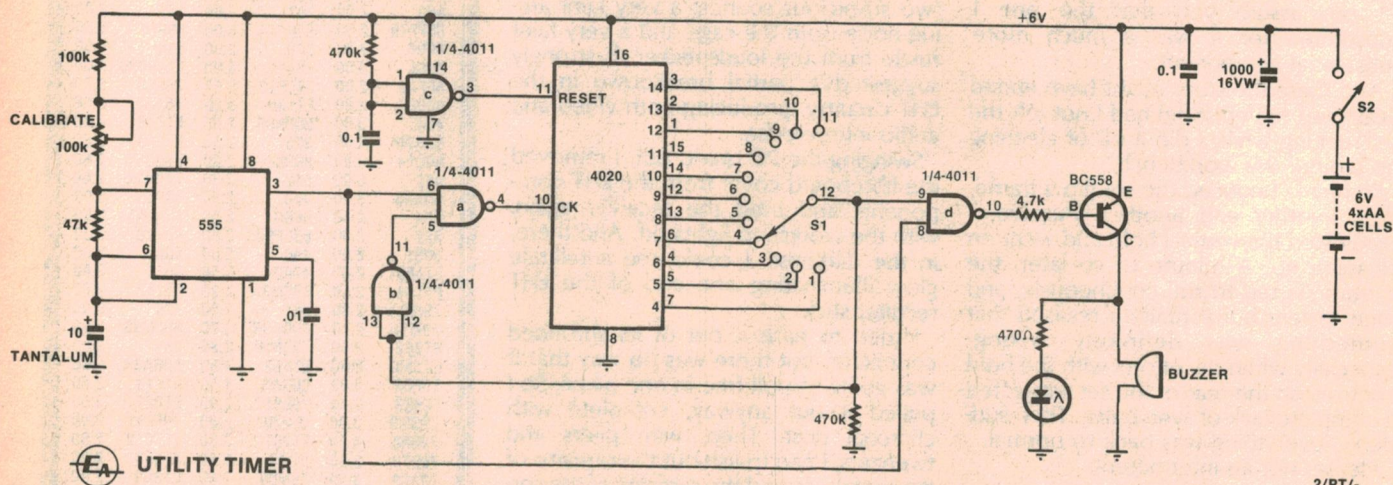


# CIRCUIT & DESIGN IDEAS

We invite readers to submit circuit ideas and solutions to design problems. Explain briefly but thoroughly the circuit's operating principle and purpose. Sources of material must be acknowledged and will be paid for if used. As these items have not necessarily been tested in our laboratory, responsibility cannot be accepted.

Conducted by Ian Pogson

## Modification gives pulsed output for Utility Timer



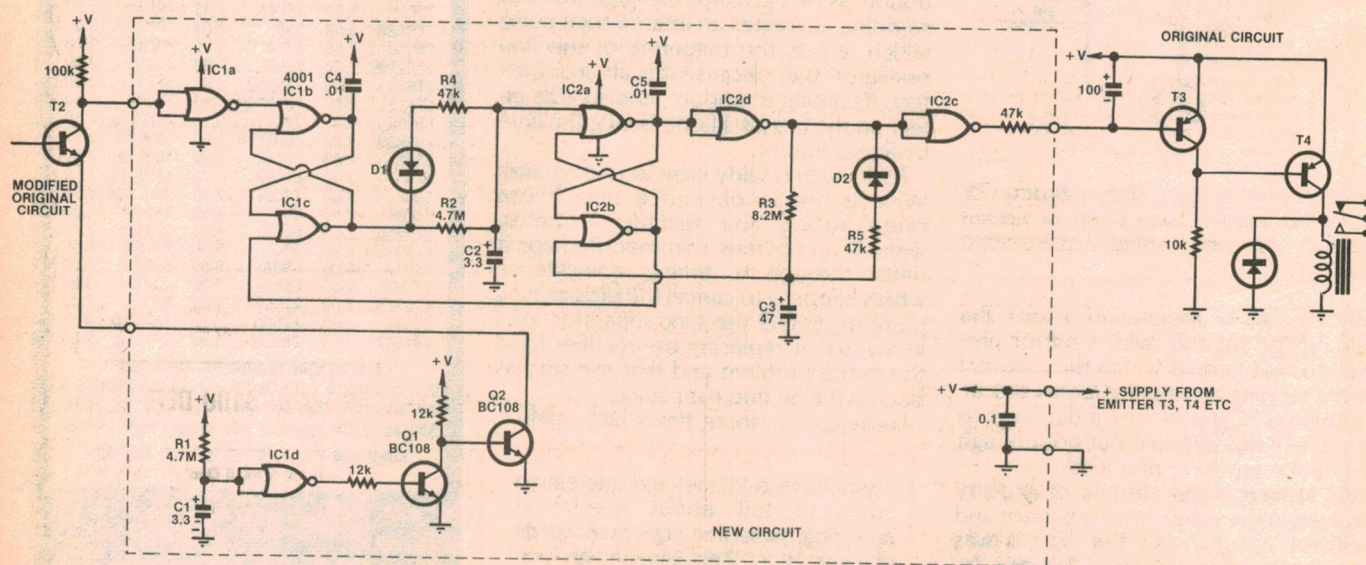
This simple circuit modification provides a pulsating output for the timer as described in August, 1978. The continuous sound from the original design sounded too plain to me so I decided to try to improve this, together with adding a LED across the output. The only extra components are a resistor and a LED.

Pins 8 and 9 of the 4011(d) are separated and pin 9 is left connected as in the original circuit. Pin 8 is connected back to pin 3 of the 555. When the selected output from the 4020 is high, the 4011(d) is switched on and off by the pulse from the 555 and thus a pulsating sound is heard from the buzzer. As a

visual indicator, a LED and a 470 ohm resistor are added in parallel with the buzzer. This has no adverse effect on the circuit and only draws a very small amount of current.

(By Mr K. Hamilton, 2 Judges Court, Reservoir, Victoria 3073.)

## Additions to 10GHz Radar Burglar Alarm provide useful delays



The following is a description of the additions which I have made to the 10GHz Radar Burglar Alarm, described in July, 1977. It provides exit and entry delays

together with an alarm timer. The modified circuit has been installed and it is running quite satisfactorily.

The ON/OFF switch is wired to supply

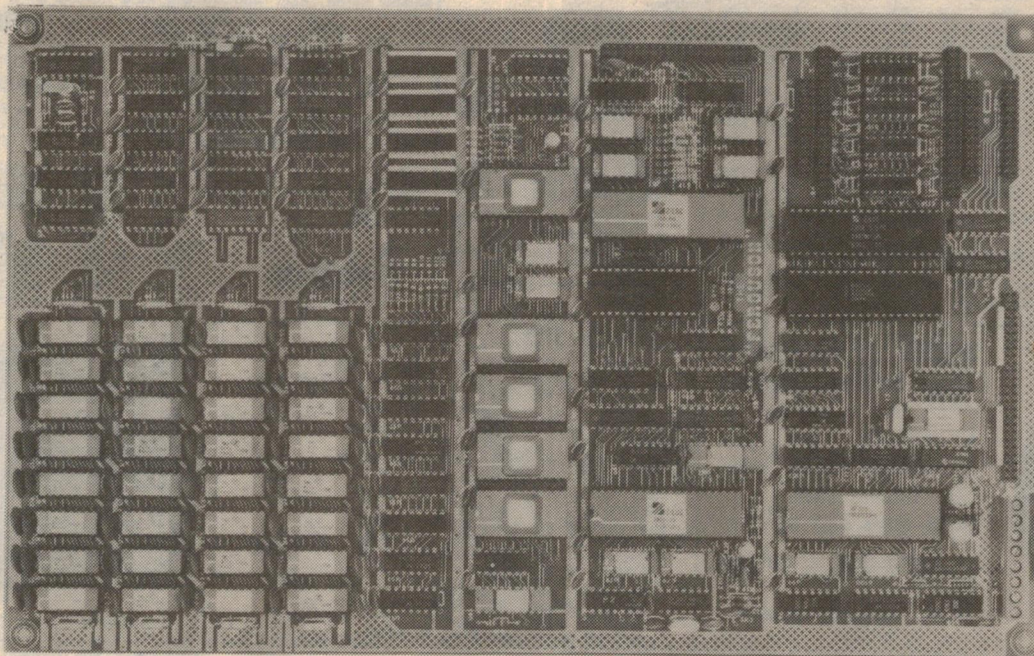
power to the alarm unit and this additional circuit. At switch-on, Q2 is off and prevents T2, in the alarm unit, from conducting. C1 then charges via R1 and after



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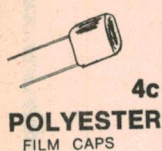
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.0033 - 5c	.033 - 7c	.33 - 18c
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22uF	6c(\$3 3/4)	7c(\$4)	
33uF	8c(\$4)		
47uF	9c(\$5)	10c(\$6)	11c(\$7)
100uF	10c(\$6)	12c(\$7)	14c(\$11)
220uF	12c(\$8)	16c(\$10)	35c(\$17)
470uF	16c(\$12)	22c(\$16)	45c(\$30)
1000uF	22c(\$18)	30c(\$25)	75c(\$50)

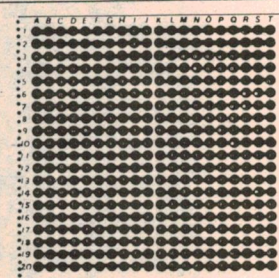
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about 25 seconds, the output of IC1d goes low, turning Q1 off and Q2 on, so that T2 can conduct. This 25-second period is the exit delay time, after which the circuit will sense movement.

When movement is detected, the collector of T2 goes low. This signal is inverted by IC1a and causes IC1b and IC1c to latch. The latch output is delayed by approximately 25 seconds before causing IC2a and IC2b to latch, giving time

for the property owner to switch the alarm system off. If the system is not switched off within 25 seconds, the alarm will sound and continue for approximately five minutes, after which time it will automatically reset. The system is then almost immediately ready for sensing the next movement.

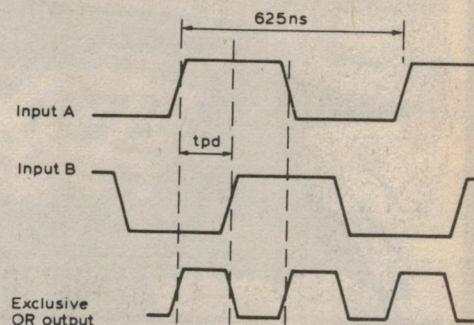
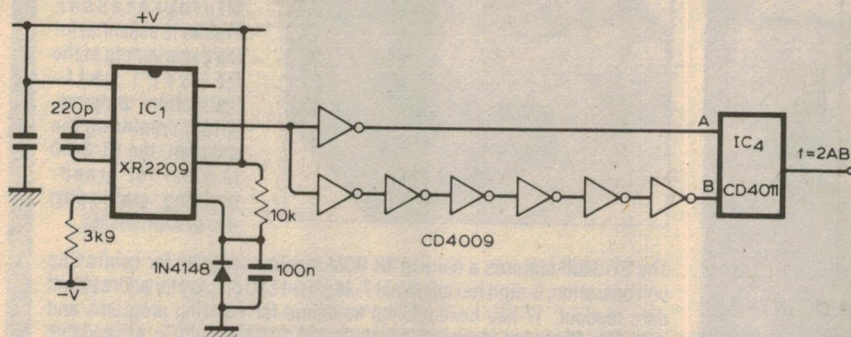
Capacitors C4 and C5 ensure correct start-up conditions for the two latches. Gates IC1a and IC2c are provided for

correct interfacing into the original circuit.

These are the modifications which are to be carried out on the original circuit. Remove the two 47k collector resistors from T2 and replace with one 100k resistor as shown in the circuit. Unsolder T2 emitter from the PCB to allow connection to be made to the new circuit. Make connection to T3 base from the new circuit. Make connection to T2 collector from new circuit. Make positive and negative power supply connections to new circuit.

(By Mr E. Rodda, 34 Abberville Terrace, Marion, SA 5043.)

## High frequency doubling with CMOS



High-frequency doubling can be achieved by using the propagation delay of CMOS together with exclusive-OR gating. The circuit shows an oscillator operating at 1.6MHz and an exclusive-OR gate fed with the oscillator output and an inverted and delayed output. Propagation delay of the buffers depends on Vdd and the load capacitance but for a

7.5V supply and a load capacitance of 50pF, the delay for each buffer is about 34nS. Therefore, the total delay for six buffers is 204nS and the difference between the two signals is 170nS, which produces a 3.2MHz output with an almost equal mark-to-space ratio.

(By D. J. Greenland, in "Wireless World", May, 1980.)

## VDU mod gives 64 characters per line

The "Electronics Australia" VDU (February, 1978) in its original form provided 16 lines of 32 characters but only used half its available memory. For RTTY use this means that two VDU lines are required for one teleprinter line. (A teleprinter will accommodate up to 68 characters.) This modification uses the whole memory capacity to enable 64 characters per line, making the VDU more compatible with printer format.

All that is required is one 7473 TTL dual JK flipflop. The flipflops are wired in a divide-by-two configuration.

The modification is as follows:

1. Replace the crystal with one at 9.4MHz, or use a capacitor network to tune to 9.4MHz. (A CB overtone crystal may also be used.)
2. Cut the track to pin 14 of IC2 and insert one divide by two section between pin 14 of IC2 and pin 3 of IC9.
3. Cut the track to pin 14 of IC36 and insert the other divide by two section between pin 14 of IC36 and pin 12 of IC26.

(Incidentally, it is possible to power the 7473 by "piggy-backing" on an existing IC.)

4. Cut the track to pin 14 of IC43 and connect pin 14 of IC43 to pin 14 of IC36.
5. Cut the tracks to pins 11 and 12 of IC37. Connect pin 12 of IC37 to pin 14 of IC36. Connect pin 11 of IC37 to pin 2 of IC29. Connect pin 1 of IC29 to ground (pin 15).
6. Cut the track to pin 1 of IC7 and connect pin 1 of IC7 to pin 2 of IC29. This completes the modification.

One problem that can arise is that on switch-on, the second flipflop may start in the flip or flop condition, meaning that the lines will start in the middle of the screen instead of the left hand side. The simplest cure is to mount a momentary push switch somewhere convenient and connect between ground and the "clear" pin of the 7473 IC. The switch becomes a "screen reset" function.

(By J. Morrison, ZL2TGX, in "Break-In", August, 1980.)

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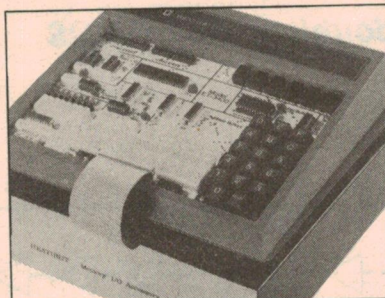
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# Early microphones ran on town gas!

It wasn't until 1876, when Alexander Graham Bell invented the telephone, that anyone needed a microphone. Indeed the microphone on Bell's first telephone was highly unsatisfactory, although it did pave the way for a flood of new designs. Some of those early microphones even ran on town gas!

by DR CLIVE COOGAN\*

"Can you lend me a match? I want to light the microphone." or "Did you remember to fill up the microphone?" These phrases seem to have slipped a bit from popular usage! But they had their heyday — once.

Some of the original microphones were weird and wonderful affairs which operated on principles which we have long since discarded. Or have we? These things have a disconcerting habit of re-appearing, often with the principle completely inverted, as we shall see.

When Alexander Graham Bell invented the telephone in 1876, he produced it complete with an earphone similar to that which we know today — an electromagnetic coil which exerts a pull on a thin iron diaphragm, so that variations in

current through the coil cause vibrations in the diaphragm and so produce waves. This established itself, with a few improvements, as a highly satisfactory method of converting modulated electric current into sound. But less satisfactory by far were the microphones. In fact none were really very satisfactory until Hughes appeared with his carbon rod microphone, and several generations of telephone "mouth pieces" were based on this simple device. Nevertheless, Bell opened the floodgates of invention with his 'phone, and numerous ingenious attempts were made to produce improved microphones.

The day of the gas-fired microphone is long departed, but a few memories linger on. We find it all very strange to-

day, as we think electrically, but in the gas-based days of last century, with gas light, gas stoves, gas stage lights (lime light) and even gas suicides, it was more normal to think of utilizing what was at hand.

It all started with Bell's telephone. No one needed a microphone (or since it did not have that name in 1876 when Bell made his world-changing invention, a voice transducer) until Bell conceived of the idea of voice transmission.

Bell's own original voice transducer was not very satisfactory. In fact it was identical to the earpiece or, in other words, an unamplified magnetic microphone. However, fortunately Professor G. Hughes came up with the first of a long line of variable contact pressure microphones early in 1878. It is called the "pencil microphone" and consisted of a pointed rod of carbon resting in depressions in carbon cups. Variations in air pressure due to sound wobbled the carbon "pencil", varying the contact between pencil and cups and thus varying the resistance encountered by current flowing in the circuit of Fig. 1.

Hughes gave this device the name microphone because of its great sensitivity (by the standards of the day). The name stuck.

A little later in the same year Edison took out a patent on a related device, and his was the first to use granular material to multiply the effect Hughes employed. He packed lamp-black into a cavity between a solid metal back and a flexible metal diaphragm. The variations in pressure on the lamp-black caused variations in resistance which could be utilized by putting it into a circuit with a "telephone receiver" as it was then called.

But all was not perfect. The early microphones left much to be desired in terms of reliability and frequency fidelity. So the search went on relentlessly for the next 100 years and maybe we have not yet arrived at the ultimate form.

An English parson named Hunnings started the ball rolling with the type shown in Fig. 3. The body of the microphone was made of wood or ebonite and the current was passed between the carbon plate (via the wire A) through loosely packed carbon granules (instead of lamp black) to a platinum foil diaphragm D. Eventually this became,

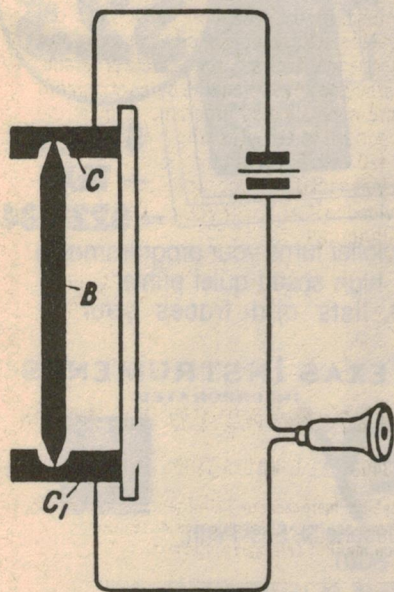


Fig. 1: Hughes' pencil microphone.

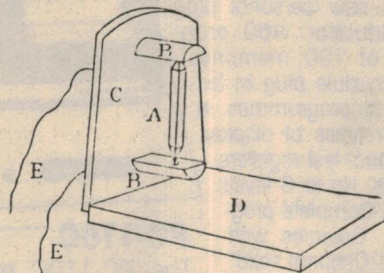


Fig. 2: Physical form of the Hughes microphone. The board at the back acted as a "resonator" (from Deschanel).

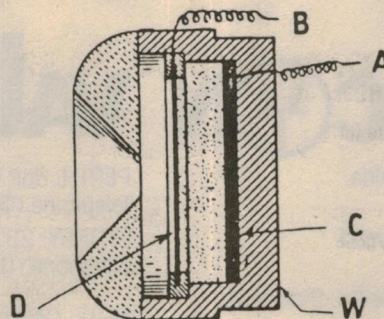


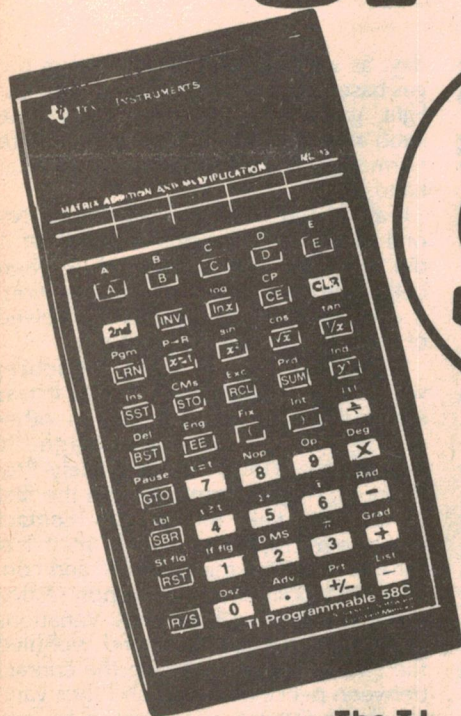
Fig. 3: Hunnings' carbon microphone.

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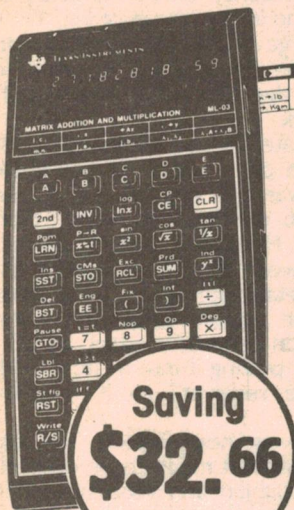
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many inventors later, the British "Post Office" microphone of Fig. 4. The movement of the diaphragm D is now allowed to move a plunger in the carbon granule chamber. This reigned supreme for many years.

The only way to increase the output of the carbon granule microphones was to pass more current through them. But this heated the granules, and at higher currents the heating tended to make the carbon granules sinter into a solid pack.

The next logical step was to cool the microphone and Fessenden did this in 1906 with his water cooled microphone of Fig. 5. It would pass 15A without packing the carbon. Its body S was turned from soapstone. Two platinum electrodes at front and back of the space loosely packed with carbon granules are water cooled by jackets W-W<sub>1</sub> and W<sub>2</sub>-W<sub>3</sub>. Dubilier "improved" on this in 1911 with a very complicated version which could handle 700W, enough power to drive a small steam engine or a motor mower!

Meanwhile others were trying to exploit different principles. Rayleigh, in the Cavendish Laboratory, had discovered "sensitive flames" which could be vibrated by sound waves. Others had noticed that gas flames were moderately good conductors of electricity, but that the conductivity varied through the flame. These principles sired a new family of microphones — the gas-fired phones.

The first of these was Blondel's manometric microphone of 1902 shown in Fig. 6. The electrodes A, B were set just beyond sparking distance (for the voltage across them), Town gas came into a chamber C via the tube T. When the diaphragm vibrated the pressure in the chamber changed and the flame fluctuated in length, so that sparks occurred in synchronism with the movements of the diaphragm D.

Later, in 1909, Chambers improved on this by lowering the resistance of the flame as shown in Fig. 7, by introducing volatile salts in the cup G. These introduced more ions into the flame and raised its conductivity.

In 1903 Lee de Forrest had patented the flame detector or rectifier, and in 1911 Mellinger elaborated on the invention, combining Chambers' idea of enhanced flame conductivity with de Forrest's principle. The "flame audion" is shown in Fig. 8. The gauze is to minimize flame flicker. The negative electrode above it contains volatile ionizing salts. Bearing in mind the fact that this resembles the flame microphone of Chambers, there must have been wonderful scope for cross modulation from noise in the room, and for acoustic feedback oscillation, although the mind boggles at Nyquist diagrams involving phase lag in flames!

A little later, in 1913, Horton devised a gas amplifier, shown in Fig. 9. The electromagnet B pulled the diaphragms D

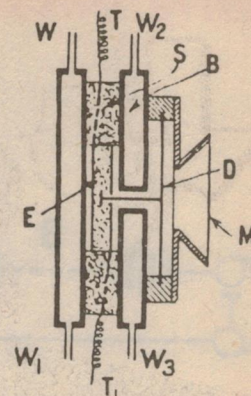
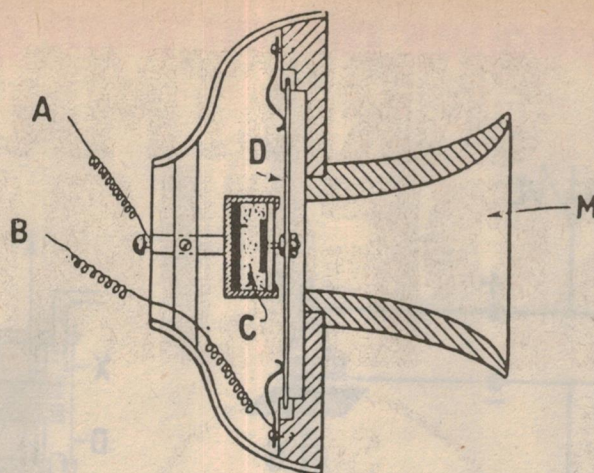


Fig. 4 (left): the English Post Office solid black microphone. Fig. 5 (right): Fessenden's water-cooled carbon granule microphone.

and D<sub>2</sub>, and pressure modulated the gas flame G in the gap between the plates P and P<sub>1</sub>.

De Forrest took it all a little further in 1923. He used a "batwing" flame of town gas or oxy-acetylene, and obtained excellent fidelity with music. In his best model, the platinum electrodes were encased in quartz, which he found to be conducting at the temperature used. It was said to be very sensitive; a gramophone placed one metre away could be clearly heard in the earphones!

Of course the principle of sound waves wiggling a conductive body of ionized gas can be applied to gases ionized otherwise, regardless of the origin of the ionization. So it was logical to try the same phenomena using electric discharges, which produce ionized gases. Phillips Thomas of the USA produced this kind, using a glow discharge, in 1923, as shown in Fig. 10. Fig. 10A shows the basic circuit he used, 10B the form of the hardware, suspended from a spring mount to isolate it from vibration, 10C the shape of the glow, and 10D a variation in design using a third electrode, close to the anode, as the sen-

sitivity was found to be almost entirely in the positive portion of the discharge.

In 1924 the Westinghouse station KDKA in New York broadcast the beating of a human heart using a Phillips Thomas glow discharge microphone placed on the patient's chest. This broadcast was picked up in Europe.

It seems that about 1923 gas-flame microphones burnt themselves out, so to speak, thus ending what now seems to us to have been a rather strange dalliance in the development of the microphone. Not much seems to have been heard of them since. Why then? Did the price of gas rise suddenly? Were there new fire regulations? Perhaps it was the onset of widescale commercial broadcasting, which happened just about then, which accelerated the comparisons between the various competing microphones.

In a sense they re-emerged in 1958, in an entirely different form. Until 1958 there was a progress-halting need for a better detector of organic molecules in what was then the new technique of gas chromatography, which (briefly) is a technique of sorting out the types of

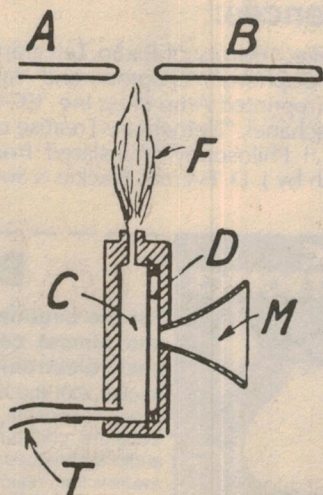


Fig. 6: Blondel's gas flame microphone.

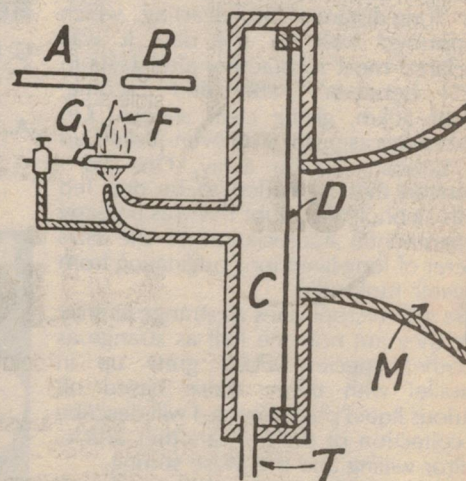


Fig. 7: Chambers' improved gas microphone.



# Early microphones ran on town gas!

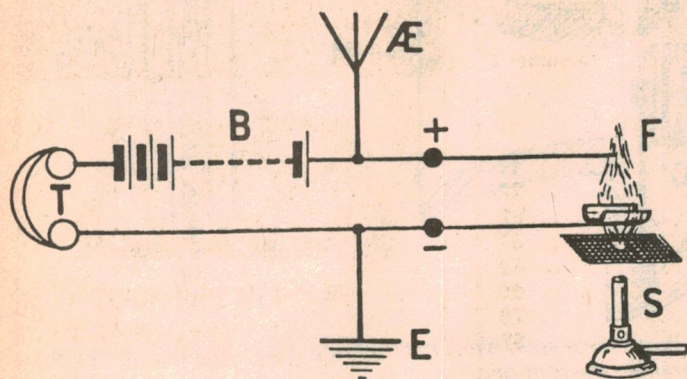


Fig. 8: The "flame audion" of Mellinger. The receptacle in the flame contained volatile ionizing salts.

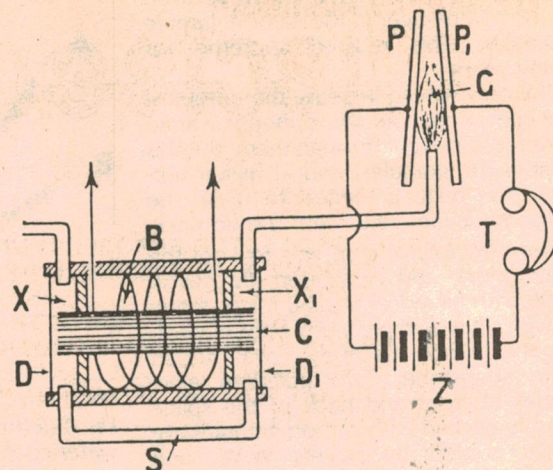


Fig. 9: Horton's flame amplifier. The pump modulated the gas pressure.

molecules in a gas mixture in order to analyse them.

The fact that today gas chromatography is one of the most widely used analytical techniques in modern science owes much to the invention in 1958, in the ICI ANZ Melbourne laboratory by Ian McWilliam and Ray Dewar, of the Flame Ionization Detector. They used the fact that an oxy-hydrogen flame has very little longlived ionization in it, but if organic molecules are injected into it ionization appears. The FID apparatus is somewhat like Fig. 6 and is incredibly simple in view of its amazing sensitivity.

In their initial paper McWilliam and Dewar reported that they had filled a syringe with acetone vapour, and had then expelled the vapour and refilled (and expelled) with air 200 times. They then injected the 201st refill of clean air into the FID and got full scale deflection due to the lingering remnants of acetone!

There are other interesting by-paths along which we could have ambled. For example there was Dubilier's arc, used for "long-distance" broadcasting, which performed well for the day. It was declared most satisfactory after tests in 1911 between Seattle and Tacoma, about 50km, giving clear speech. On several occasions it was even picked up at Tatoosh, 200km away. Oh, did I mention that it needed to be drip fed with alcohol! No doubt this was an early experimental appreciation of the FIDs secret of long-lived ions originating from organic molecules.

Be gas microphones as strange as may be, they are not one half as strange as another species which grew up in parallel with them: those based on various liquid phenomena. I will describe a collection of these in another article, Editor willing and the Muse stirring.

Meanwhile, do check if all microphones are extinguished before going to bed.

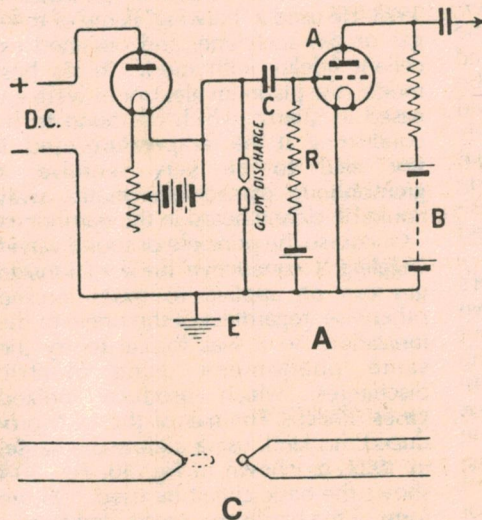


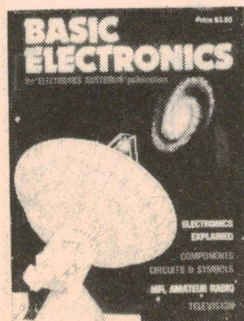
Fig. 10: Phillips Thomas' "glow discharge microphone". A: the microphone amplifier circuit. B: the physical form of the microphone (less suspension springs). C: the nature of the glow discharge. D: the 3-electrode model.

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- A. P. Deschanel, "Elementary Treatise on Natural Philosophy" translated from French by J. D. Everett, Blackie & Son, 1897.

Professor P. H. Sydenham, "Measuring Instruments: Tools of Knowledge & Control", Peter Peregrinus, Ltd, in association with the Science Museum, London, 1979.

Silvanus Thompson, "Electricity and Magnetism".



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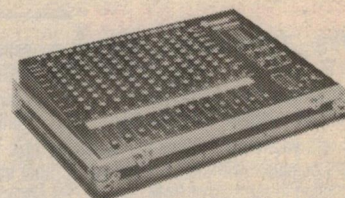


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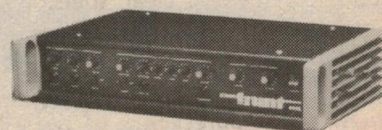
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  - SORT: In core sort of variable length records.
  - XDIR: Extended, alphabetical directory listing with groupings by common extension.
  - PRIN1: Formatted listings to printer.
  - PG: Lists files to CRT a page at a time.
- plus more...

Requires: 24K CP/M.

Supplied with instructions on discette: \$50.00.

## PROGRAMMING LANGUAGES

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'Tiny' Pascal is perfect for writing text processors, real time control systems, virtually any application which requires high speed. Requires: 36K CP/M. Supplied with complete user manual and source on discette: \$85.00.

Manual alone: \$10.00.

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- payroll files
- programs
- general ledger
- correspondence
- tax records
- inventory
- accounts pay/rec
- mailing lists

Encode/Decode is available in two versions:

Encode/Decode I provides a level of security suitable for normal use. Encode/Decode II provides enhanced security for the most demanding needs.

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Manual alone: \$15.00

## INTERCOMPUTER COMMUNICATIONS

**TERM:** a complete intercommunications package for linking your computer to other computers. Link either to other CP/M computers or to large timesharing systems. TERM is comparable to other systems but costs less, delivers more and source is provided on discette!

With TERM you can send and receive ASCII and Hex files (COM too, with included conversion program) with any other CP/M computer which has TERM or compatible package. Allows real time communication between users on separate systems as well as acting as timesharing terminal.

- Engage/disengage printer
- terminal mode for timesharing between systems
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- error checking and auto retry
- conversational mode
- receive files

Requires: 32K CP/M.

Supplied with user manual and 8080 source code: \$110.00

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# 4K RAM Expansion for the DREAM 6800

The long-awaited DREAM 6800 expansion project is here! This uncomplicated circuit allows DREAM users to expand their computer's memory to a total of 4K and fits inside the cabinet of the original DREAM. It's just the thing for those who have gone beyond the initial stages of programming and now wish to write longer programs.

by K. ZALKALNS

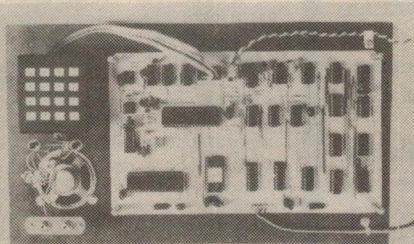
Although CHIP-8 is a very memory efficient language, I and no doubt other owner-drivers of Dream computers have had times when the available memory storage is just not large enough. A quick answer is to make simpler therefore shorter programs, but that seems to be a retrograde step.

With more RAM, various possibilities suggest themselves. Often used subroutines could be pre-stored at the top of the stack, and called from a number of programs, a block of programs could be entered at once and a key pressed to select a chosen program, or even "number crunching", etc, etc. But enough of suggestions. After building the board you can dream up your own ideas on how to use it (sorry about the pun).

I decided to limit the expansion of memory to a total of 4K. This is the maximum extension which is possible

without buffering the data and address lines, and in any case the 12-bit address operand of the CHIP-8 language will only allow addressing up to location OFFF (4095 decimal). Because of the efficiency of the CHIP-8 language, 4K of memory should be ample.

To keep the circuit simple several



*Published in May, June, July and August 1979, the DREAM 6800 was a highly popular project.*

signals are taken from the main board. The conditions required to address the RAMs for the CHIP-8 use are that address lines 14 and 15 are low and lines 10 and 11 are decoded to select the correct 1K block (see table 1). The signal for the former function is already available at pin 6 of IC10 (74LS10), labelled RAM and can be used as the enable input for the address decoder ( $\frac{1}{2}$  74LS139). The four decoded outputs (active low) are then used to select the correct RAM. The Read/Write function is also available at IC10 (pin 12) and is fed to the WE input of all RAMs.

The only further decoding required is to supply RAM1 with the BA signal for DMA (Direct Memory Access) use for the video page. This can be achieved in two ways. The first is to cut the track near pin 13 of IC12 and apply the C1 signal from the extension board to the same pin, leaving the main board RAMs in their current location. The other method, which I opted for, is to use one gate of a 74LS08 on the extension board with the BA signal taken from the expansion bus. This does mean most of the package is unused, but the price is low enough and the main board doesn't have to be mangled in the process. If you use this approach there will be no RAM chips on the main board. The entire 4K memory will be on the expansion board.

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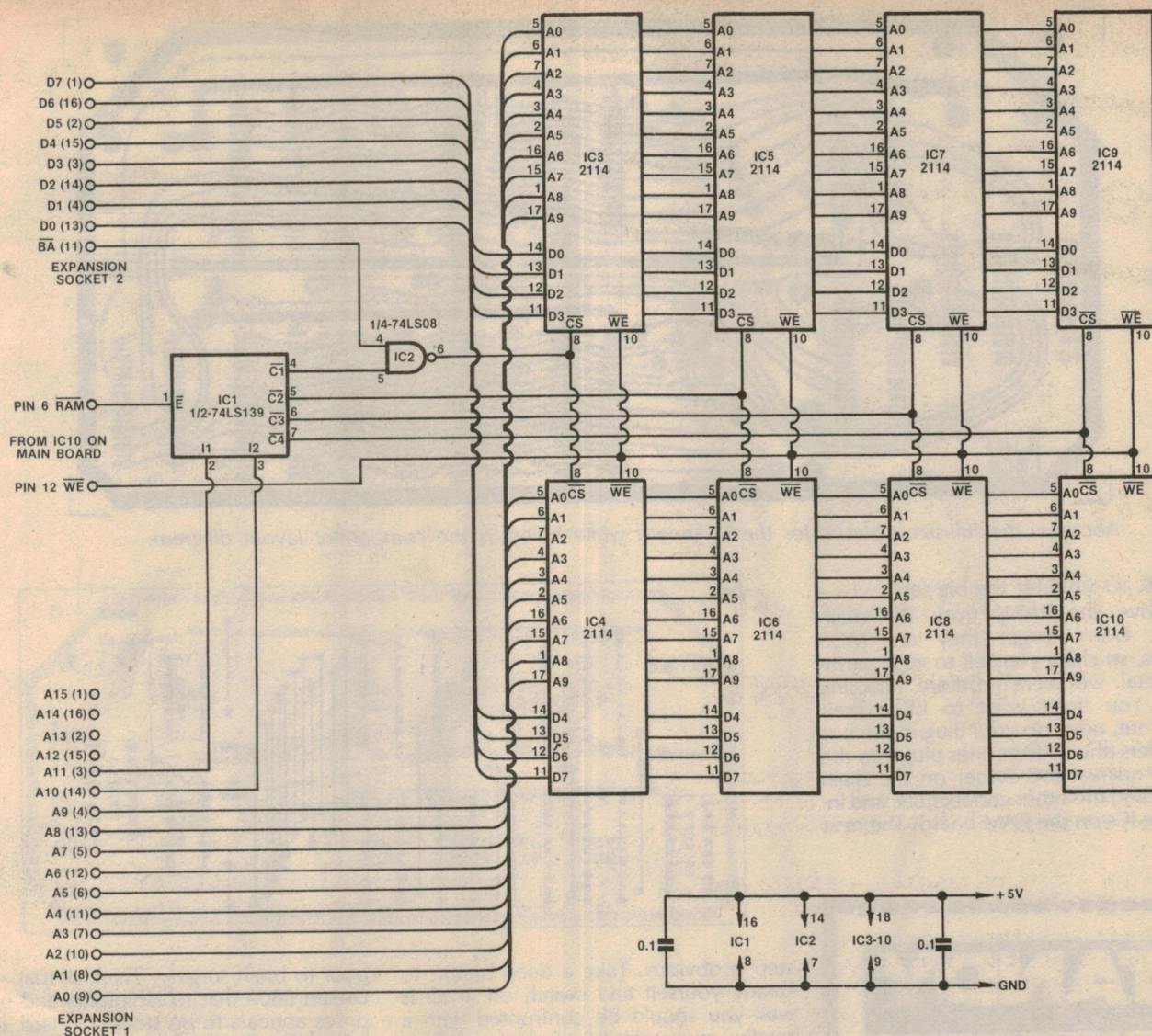
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**EA 4K RAM EXPANSION FOR DREAM 6800**

2/CCI-

Just two ICs, in addition to the memory chips, are required for this RAM expansion.

As can be seen from the board pattern, a single sided board has again been used to keep the cost down, so there are a number of wire links to install. Whether you make your own board or buy one, the first job should be to check for shorts or breaks in the tracks, as most of them, of necessity, are closely spaced and quite narrow. Next, solder the 23 wire links, using sleeving where necessary. Install IC sockets for the RAMs and bus extension at least, and finally the two capacitors and TTL ICs.

The extra two signals  $\overline{\text{RAM}}$  and  $\overline{\text{WE}}$  must now be obtained from the main board. If you didn't follow the advice given for building the main board, and did install sockets for all the ICs a simple method is available. Take a 14 pin header, solder and an IC socket to the top and like magic, you've now got a high rise socket for IC10. Solder leads from pin 6 ( $\overline{\text{RAM}}$ ) and pin 12 ( $\overline{\text{WE}}$ ) and you're in business. If you did solder the ICs either PC pins will have to be installed at the correct locations, or alter-

natively, the two leads could be soldered to the bottom of the board. The only other leads required are for power, which can come from the two pads between the expansion sockets on the main board.

The extra board has been designed to mount above the main board over the expansion sockets by using spacers and longer screws. Prior to fitting the board, thoroughly check it again. It's better to be safe than sorry. If everything checks



## One-Second Desoldering

# with SODER-WICK



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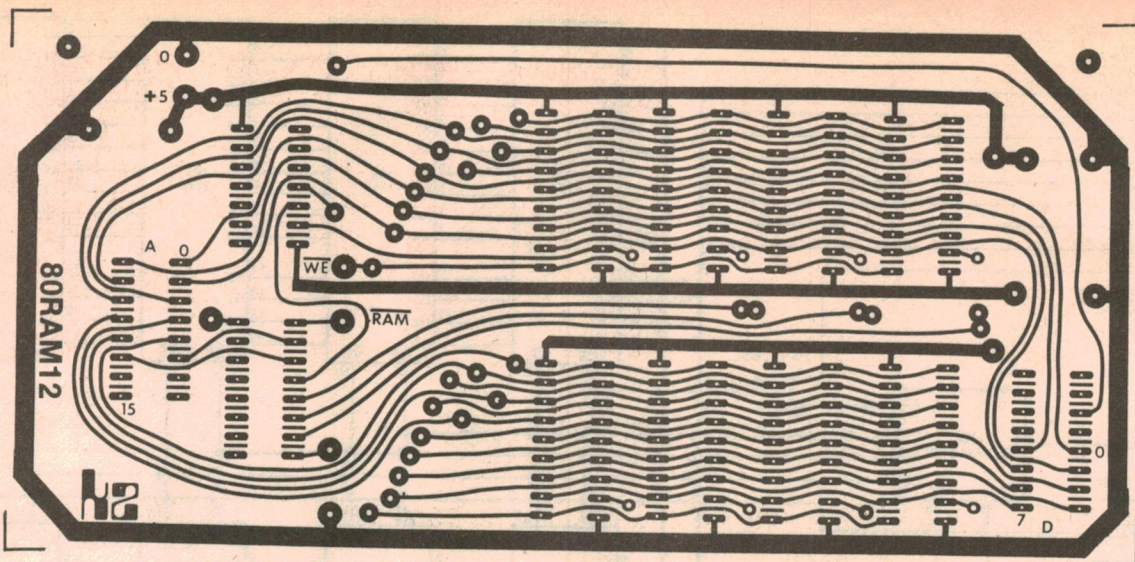
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S-W-3

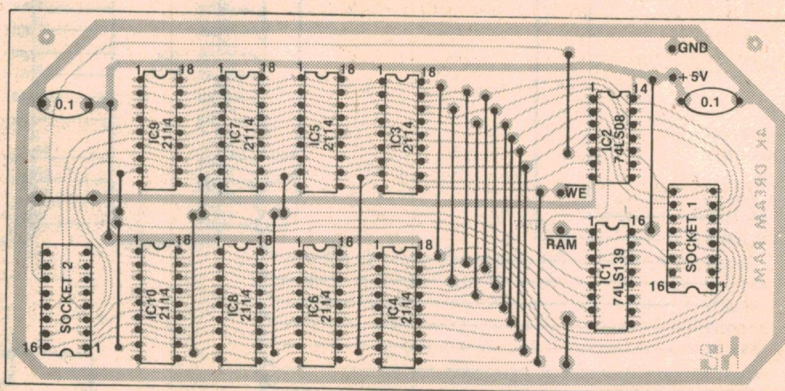




Above is the full-size artwork for the PC board while below is the component layout diagram.

out OK, it's time for the big test.

Remove the RAMs from the main board. Don't forget they are MOS devices, so chain yourself to your earthed metal workbench before handling them. You don't want to blow their brains out, now, do you? Plug in the bus extenders (the address lines plug into the socket nearest the corner on the main board) and the other connections and insert the ICs on the RAM board. The next



step is obvious. Take a deep breath to steady yourself and switch on. If all is well you should be confronted with a totally awe uninspiring picture, very similar or identical to the one displayed

prior to brain surgery. Think of that — a Dream 6800 that to all intents and purposes appears to be stock-standard, but is in reality waiting for you to fill it's vast memory with useful things to do. ③

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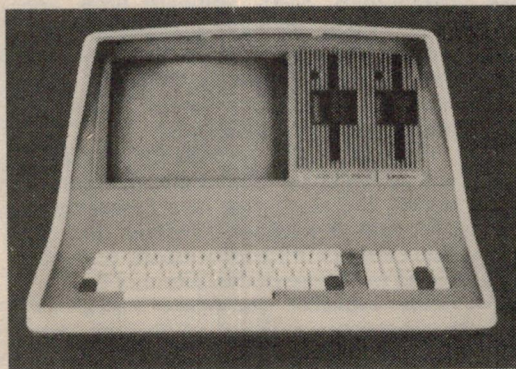
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$$A^2 + B^2 = C^2$$

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$$e_{rms}^2 = 4KTR(f_2 - f_1)$$

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$$L_1 = 10 \log \frac{1}{80} \times S_n \text{ (dB)}$$

$$A^2 + B^2 = C^2$$

$$A^2 + B^2 = C^2$$



# Is this the programming language of the future?

# PASCAL

by A. J. SALE

Professor of Information Science,  
University of Tasmania.

Pascal is expected to be the next programming language to be widely implemented on microcomputers. Its adherents claim that its firm basis in structural principles make it easy to use and give it a power and flexibility unmatched by other languages. However, as this article reveals, even Pascal has its shortcomings.

If you pick up a journal that deals with microprocessors and their design or applications, you will soon find the programming language Pascal mentioned. It is common to find that microprocessor engineers and programmers who use Pascal genuinely believe that it is better than any of the alternatives, provided they made an effort to get to know it. Why?

Perhaps the main reasons can be outlined as follows:

- Pascal is a programming language based on firm theoretical principles and good data structuring methods.
- It is designed to make it easy to write correct programs and difficult to write incorrect ones.
- It is not difficult to generate highly efficient object code from Pascal source text.
- Because Pascal is based on abstractions rather than specific machines, programs and programming skills are interchangeable between machines.
- The data-structuring techniques which are used in Pascal usually eliminate the need for machine code programs.

Needless to say, Pascal is not perfect. It was designed to be a good general-purpose (not all-purpose) language and consequently has some deficiencies. The most important of these is the lack of any real-time features.

In the following sections each of these points will be expanded and discussed; but first some background.

## BRIEF HISTORY

Pascal was developed in the late 1960s by Professor Nicklaus Wirth in Zurich. His aim was to create a programming language based on a small number of fundamental concepts which would be structured to allow programming to be taught as a systematic discipline, and at the same time provide a powerful and concise language for the development of complex system software.

The acceptance and spread of Pascal has been so rapid that, for example, it is

now taught in about 90% of the Australian universities that have computer science departments.

Although first implemented on big computers, Pascal is not restricted to mainframes. Many software firms are now writing accounting packages and word processing systems in Pascal for use with minicomputers. However until recently implementations of Pascal for microcomputers were rare.

There were two reasons for this; size, and architecture. Until memory costs reduced, the sheer size of a Pascal compiler was a deterrent. Further, the architecture of microprocessors was not suited to the use of the output of the currently available compilers. Pascal for microprocessors has had to wait until someone had the time to write a compiler specifically designed for micros.

These problems have been largely overcome. Firstly, an interpreter-based Pascal system, originated by the University of California at San Diego (UCSD), has been applied to microprocessors. A version of UCSD Pascal is now available for the Apple II, running in about 48K bytes, which provides an operating system, compiler, graphics, file management, etc, all on a single mini-floppy disc.

Secondly, a microprocessor has been designed specifically to run Pascal; the Western Digital Pascal Micro-Engine. No-one has ever even suggested designing a machine specially to run Basic!

Thirdly, optimising compilers now exist. Typically these are cross-compilers, running on a microcomputer or mainframe but generating code for a microprocessor, which can then be loaded into a ROM.

## THE ROLE OF ABSTRACTION

The first and most important reason for the popularity of Pascal is the high level of abstraction of the language.

Languages designed in the early days of computing may be characterised as *flat*; or in other words they are all of a single

level. Reasonably good examples are Fortran and Basic. The flow of control through a Basic program is basically sequential, with linkages set up by GO TO or IF statements. (The FOR-NEXT construct is an exception.) It resembles a bowl of spaghetti: the flow of control is difficult to understand and it is very difficult to make anything substantial out of it. Pascal follows the direction that Algol 60 and PL/I indicated; the flow of program control is generally specified by some simple compound constructs.

In the case of Pascal, however, the compound constructs are chosen to conform to one of the basic tenets of structured programming; there should be only **one** entry point to the construct and **one** exit point.

Pascal, being a practical language, as well as a good one, still retains the goto-statement for emergency use. It is very seldom used as it is not necessary for most purposes.

However the underlying abstractions are not restricted to the control flow. Even more importantly, the basic data types are well-founded and a good set of structuring methods are provided. To take the basic or primitive data types first, Pascal builds on the work of C.A.R. Hoare, and provides facilities to define types which consist of a small enumerated set of values:

### type

SwitchStatus = (On, Off);

GirderSection = (Channel, Ibeam, Box, Tbeam, Other);

It is therefore not necessary to encode switch positions into boolean values for example (which they are not) nor to encode GirderSection into small integers. You can define types which are more natural to the problem. Such a facility does not exist in any other commonly used language. Of course, the important specialised types which are familiar from these older languages also exist, and are regarded as pre-defined types:

boolean truth values = (false, true)

char the character set, eg, "a", "b",  
..., '\*', ... etc

integer the whole numbers in a finite range

real the approximations to real numbers over a finite range

Pascal provides five structuring methods for packaging up data and all of them are provided with considerable generality. The most familiar to Fortran



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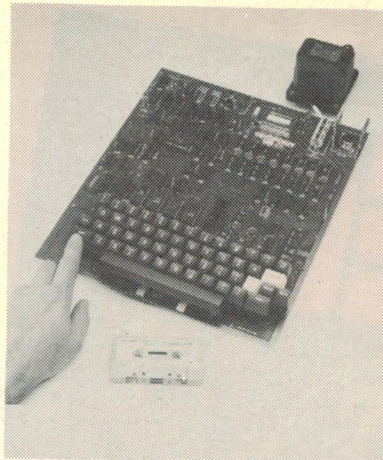
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or Basic programmers is the array typing method (dimensioned variable in older languages). The basic abstraction lying behind the array concept is that an array is a **mapping** from each value in an **index type** onto a **component type**. In Pascal, an array type declares just those things:

```
type
Register = array [BitRangeType] of
    Boolean;
Histogram = array [Category] of Load;
GirderData = array [GirderSection] of
    Inertia Moment;
```

The next basic structuring method is that of the **record**. A record is an agglomerate of possibly differently typed objects and serves to represent two basic abstractions: the **cartesian product** (where all values form some sort of composite) and the **union** (where one of the possible values and no more at any one time is the composite value).

```
type
Spotlight = record
    switch: SwitchStatus;
    filter: (White, Red, Yellow,
        Green, Blue);
    kVA: real;
end;
```

The above example illustrates the product: all of the listed attributes describe the composite object to which we agree to give the type name **spotlight**.

```
type
TwoPinPowerSocket = record
    case supply: SupplyKind of
    AC: (RMSvoltage: real; frequency: real);
    DC: (DCvoltage: real; polarity: (LeftPositive, RightPositive));
end;
```

In this case we see the composite object can have one of two kinds of values, discriminated by the value of the first attribute **supply**. The type **SupplyKind** should be considered to have been defined earlier by:

```
type
SupplyKind = (AC, DC);
```

The lack of this kind of structuring in Basic and Fortran requires programmers in invent clumsier substitutes and to maintain control of their substitutes. In Pascal this is automatic. For example, if **Socket 21** is a variable of type **TwoPinPowerSocket** then we can write a brief program to print out its characteristics:

```
if (Socket21 supply = AC)
then begin
write ("AC: AT", Socket 21.frequency,
"HZ");
end else begin [it must be DC now, of
course]
write ("DC: POLARITY");
if (Socket 21 polarity = LeftPositive)
then begin
```

```
write ("+-");
end else begin
write ("--");
end;
end;
```

Two more structuring types can be covered briefly. One is the file type, which is based on the abstraction of a potentially infinite **sequence** of objects of the same type:

```
type
String = file of char;
TimeSample = file of SampleData;
RainfallRecords = file of Daily Records;
```

The other is the pointer structure. Pascal permits the creation of complicated structures involving variables by means of pointer variables. A pointer type points to an instance of its element-type. A simple example is afforded by a family tree tracing only the female line of descent. The basic types are:

```
type
PointerToPerson = ↑ Person;
Person = record
    name: string;
    mother,
    nextsister,
    eldestdaughter: PointerToPerson;
end;
```

However the structure I have left to last is probably the most useful in microprocessor applications: the set structuring method. Everyone knows about sets, they are part of kindergarten and primary school lore. Pascal has sets, so that it is possible to declare:

```
type
DeviceRegister = set of 0 .. 15;
Occurrence = set of Category;
```

The set structuring method is associated with special operations, such as \* (set intersection), + (set union) and - (set difference). Membership of a set can be tested too. The point of all this is that practically all the bit-fiddling that assembly language programmers are wont to do and which serves as an excuse to escape from the confines of a high-level language for "reasons of efficiency", can be seen to really be set operations.

For instance imagine that a set of 0 .. 15 is represented by a set of 16 bits, each of which is 1 if the corresponding value is present and 0 if not. Then set intersection is equivalent to masking (the misnamed AND); set union is equivalent to insertion (the misnamed OR), and set membership is equivalent to testing for a bit, or bits.

The concept is simple and natural but unfamiliar to many programmers simply because of the lack of it in early languages. The set type usage often can serve as an index of how far a programmer has achieved a mature Pascal style by realising its possibilities.

## CORRECTNESS AND SECURITY

Knowledge about how to design programs has progressed far since the early computers were built, or the first high-level languages defined. Just as no competent engineer would just throw a bridge together to see if it worked, no competent programmer would write a program that way either. It suffices for small programs (say less than two pages of source text) and for learning students but anything more demands greater assurance of correctness.

Testing programs is, of course, only a palliative. Testing can never prove that a program is correct, only that it isn't. Instead, good programmers design a correctness proof along with the program design, so that both progress together, in much the same way that engineers design structures. The abstractions on which Pascal is based carry with them some axioms to which they conform and which are essential for any process of logical deduction of a program's correctness.

However, there is another aspect to security. Pascal is what is called a strongly typed language. This means that all of its objects are associated with a type, and that a set of type rules enforce the use of the objects so as to limit misuse. By means of contrast, assembly languages for microprocessors are untyped (there is no concept of type in most microprocessors) and Fortran is weakly typed (there are some types, but restrictions are only weakly enforced).

The net effect of this is that Pascal prohibits most common programming mistakes. You cannot inadvertently overwrite an address with a character value, for example, unless you deliberately set out to do so. In addition, such errors are caught at compilation time, not while running. Some people object to this, probably because they are used to relative freedom. But what, after all, does it mean to use logical masking operations on integer variables? In abstract it is meaningless; at best it is representation-dependent and therefore not transferable to all computers. Pascal has therefore been called a patriarchal programming language by analogy with the patriarch of old who ruled the tribe with a rod of iron and knew what was best for them!

The net effect of these and other apparently restrictive rules in Pascal is that an economical aid to correctness is available and that most of those annoying and difficult-to-find errors that pervade Fortran programs are simply not possible. It is the hallmark of a good designer that he does not solve problems but where possible he makes them go away. Pascal does just that.

## EFFICIENCY

Without analysing the causes in detail, note that compilers for Pascal are usually



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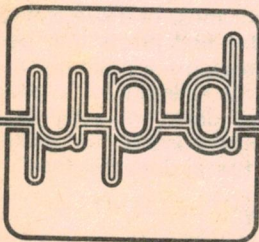
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smaller and faster than Fortran compilers. The predominant reason is the better structure of the Pascal syntax but it is also interesting to realise that most Pascal compilers are written in Pascal. We are, however, more interested in the efficiency of the generated programs.

In big-machine practice, speed is often important. The constructs of Pascal have been carefully chosen so that good code can be readily generated and it is very rare to find a Pascal system whose execution speed is worse than a Fortran or Basic compiler (unless the latter is highly optimising and the former is not.)

In small computers, and especially microprocessors, speed is seldom critical. When it is, the sections of code which consume most of the time can be given more attention. Space occupied by program and data may be much more important.

Producing compact machine code for microprocessors is the most difficult task of all. Many microprocessors require cumbersome schemes to address memory, or a plethora of special cases must be allowed for in order to write compact code. These problems are not unique to Pascal, and must be faced by all compiler-supported languages on microprocessors. (Basic sidesteps these by usually being interpretive). On computers without these addressing problems, such as minis and most mainframes, the production of compact code from Pascal is not difficult.

## PORTABILITY

There are at least two aspects to portability: the ability to transfer skills between machines and the ability to transfer programs between machines. The first is probably one of the most important to microprocessor applications, where the designer is faced with a wide range of almost equivalent processors, each with its own idiosyncratic and irregular instruction set. Attempting to cope with all of these at an assembly language level is a nightmare.

Pascal tackles this problem simply by being what it is: a high-level language based on sound abstractions. If the abstractions and the concepts that give rise to them are soundly based, then they are not specific to any particular computer. Also, if they are basic, then there will exist a reasonably efficient way of mapping the abstraction onto any particular processor. Thus the notion of an integer is a very familiar abstraction although in a particular processor the actual mapping of the integer abstraction onto machine numbers is limited by the number of available bits and cast into some concrete representation such as two's-complement, sign-and-magnitude, etc.

Pascal has no real competitor in the

transferability of skills between machines: it is the only significant and useful language to have the availability necessary. There have been, of course, other proposals but none of them have met with the acceptance that Pascal has and it is pointless to discuss non-competitors. The new language Ada (named after the world's first programmer, Countess Ada August Lovelace) which has been developed by the US Department of Defence will bear watching in a few years' time, however. Much depends on its evolution.

The second aspect of portability is the ability to transfer a program from one machine to another. This affects people who design microprocessor applications (such as traffic lights or sewing machines) because they are not necessarily locked into one supplier, or even one type of chip. It also benefits people who write software for profit, such as word-processing units, intelligent terminals, accounting software and similar applications. The present state of the art is that Pascal programs are at least as portable as Fortran programs.

Consequently, it is quite possible for a development team to work with a wide variety of microprocessors. Each will demand slightly different knowledge, such as of the I/O interfaces and their operation, but the common programming language can well be Pascal. Indeed, some software suppliers go even further and ensure that there is a family of compilers for different target computers and with uniform compiler control options, diagnostics, format, etc. This is obviously economical and sensible. However

engineers do not need to be told about the benefits of standardisation, they know them quite well already.

## WHO NEEDS ASSEMBLY CODE?

From time to time, if you program minis or micros in Fortran, you need to lapse into assembly language to achieve some particularly useful function which is not available in the language. In Pascal, that need is much diminished.

Many of the lapses can be observed to deal with bit-picking or masking or unpacking and packing structures. In Pascal, both of the first two uses can be handled through the set facilities or by utilising packed arrays of booleans. Packing and unpacking are virtually automatic and delegated to the compiler (which does the function with far less error). Therefore the excuses to use assembly language are relegated to something very foreign to the high-level language, such as an instruction that inverts the bits end-for-end in a word in preparation for an FFT algorithm or in those cases where there is a time-critical section of code which must be written to be as fast as possible.

Of course, there is nothing new in this development. I have been through the same phases twice before, with the mainframes and the minicomputers. At first the perception of a new technological breakthrough in cost drags in new people to computing. The new computers are worked on avidly and the devotees memorise the bit patterns and program the machines in binary, octal or hexa-decimal.

Then, tiring of this, they turn quickly to assembly languages. This phase lasts slightly longer, because it is still possible to indulge in "programming tricks" but

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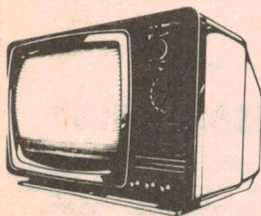
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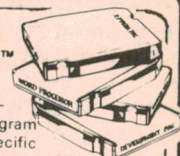
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the system makes it much easier. Then, inexorably, the level of language grows to include macros and we are climbing up the slope to even higher levels of languages. At present the mainframe users can be characterised as a mature ecology of languages; the mini-computers are in a successional stage with only a little way to go and the microcomputers are just heaving themselves out into the first flush of development. One thing extra can be said: every time this happens, it seems to take less time than before.

## REAL-TIME PROBLEMS WITH PASCAL

While Pascal permits encapsulation of some activity within a procedure or function, it does not have an adequate treatment which permits the inner details of a complex package to be hidden from users of the package. Thus the details of representation of a text-string package should be hidden from users of the package and only a few defined accesses permitted. This is not possible in standard Pascal.

In language where simultaneous (or conceptually simultaneous) actions may be specified, it is necessary to have the concept of a process, to have facilities

for starting processes and to have facilities for interlocking process while they access shared data. Pascal has none of these.

If the language is to be used to communicate with machine facilities, then either these are built in to the language (undesirable) or facilities must exist for communicating the information to the compiler. There are no such facilities in standard Pascal.

However, Pascal is so far superior to any of the older languages around and to the special-purpose products that most suppliers provide, that these very serious disadvantages have to be taken and absorbed.

Consequently, we have seen two developments taking place. Firstly, there have been a number of research projects mounted to examine the way that these problems should be tackled. These include Pascal-Plus developed in Belfast, Modula developed in Zurich, Ada developed for the US Department of Defence and several others. It is not yet clear which, if any, of these developments will be successful or useful.

Secondly, because the applications will not wait, a number of compilers have been written that provide more or less clumsy methods of getting software to

run on microprocessors, working on an extended Pascal. The Pascal community has totally resisted any pressure to standardise any of these extensions, on the very good grounds that they are demonstrably clumsy and not ideal solutions.

## CONCLUSIONS

At the present time, Pascal is the only serious language that can be considered for both designing programs that may run on a variety of microprocessors and for designing programs in such a way as to make use of the advances in software technology. Assembly languages are merely a passing phase and unsuited for anything substantial and other competitors which are at a high language level are not designed with the same care.

However, this situation will not last. In a time span of probably around five to 10 years, Pascal will have to be replaced by something more suited to the very complex task that is real-time programming.

The time-scale depends on advances in computer science and in development of software technology. After all, it took Pascal 10 years to get here.

Condensed from Proceedings of the IREE Australia, Vol 41 No. 1 March 1980.



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## Letters to the editor

### We'll let readers be the judge

After reading your comments in response to J. S. of Mulgrave Victoria in your information pages of your October issue, I was astounded and has prompted me to write.

Mr J. S. was asking for information on his AM/FM tuner clock in which he was getting all the segments enabled. He went on to say that the segments that were supposed to be enabled were brighter than the ones that were supposed to be off.

The comments made by you were obviously made without too much technical thought. If pins 25 or 28 were open circuit how would you get some segments brighter than others? The second part of your comments doesn't seem too bright either because if the clock chip was US all the segments would be the same brightness or nothing.

I have had this problem myself and I

would say it's a safe bet that Mr J. S. got his kit from Dick Smiths. The problem was that the eight transistor drivers (BC337, BC338) were substituted and a slip of paper inserted with the wrong lead information (opposite in fact) was supplied. After checking the circuit myself I discovered the problem and promptly phoned Dick Smiths (Sydney) to complain. They were sorry about the mistake and said that quite a few kits were released with this problem. They were going to put something in your magazine to warn people.

We all know the close association your magazine and Dick Smiths have, but nothing appeared. Here you are telling J. S. to buy a new \$18 IC, which I'm sure he will do and then he will still have the same problem. I wonder how many chips have been sold this way, at \$18 a pop not a bad profit for Dicky eh?

I also wonder how many other projects

have had queries of this nature and the reader put onto the wrong tram.

To qualify myself, I have been buying your magazine since February 1960, I am an electronics technician and I lecture in an electronics school.

If Mr J. S. gets the information about the transistors with reversed leads all well and good. But I'd reckon that he is \$18 out of pocket because of lack of thought on your part.

I have certified this letter to ensure you get it, but I don't hold hope of it being published in part or whole even for Mr J. S.

M. Rogerson (Mr),  
Werribee, Vic.

**COMMENT:** We are grateful for the information but not for the spirit in which it has been presented.

If Dick Smith Electronics made a mistake affecting their customers, that is where the responsibility begins and ends.

It may have been helpful to "put something in" our magazine but this is the first we have heard of it. If we had known of the alleged mistake, we would certainly have advised J. S. accordingly.

Do you really believe that a magazine of our standing, or a company as successful as DSE, can afford to — or needs to — resort to such practices as conspiring to induce our readers to double-buy \$18 ICs?

We will publish every last word of your letter and let readers judge for themselves.

### Bright/Dim Switch

I refer to an article "Add a Bright/Dim Switch to your Lights" which was published on page 53 of the October, 1980 issue of "Electronics Australia".

In New South Wales it is illegal for any person other than a licensed electrical contractor or a person in the employment of and under the personal supervision of a person so licensed to undertake or carry out any electrical wiring work including the installation, repair or replacement of power points, switches, dimmers, lighting fittings, etc.

All the work on, and the equipment used in, an electrical installation are required to meet the requirements of the SAA (Standards Association of Australia) Wiring Rules which comprise Part 1 — Wiring Methods (AS 3000, Part 1 — 1976 "SAA Wiring Rules") and Part 2 — Materials (a series of Approval and Test Specifications).

Approval and Test Specification AS C100 — 1972 Ap "Definitions and General Requirements for Electrical Equipment" is included in Part 2 — Materials, and in a published amendment to AS C100, Clause 3.12, "DC Components from AC Appliances", it has been specified that the design of equipment shall be such that any direct cur-

rent in the neutral caused by the equipment does not exceed 200mA. That amendment will become effective on and from March 1, 1981.

It would be appreciated if you would bring this information to the attention of your readers.

G. E. Stephan, Acting Manager,  
Electricity Distribution,  
Energy Authority of NSW.

### Power Saver

We note your reference to copyright and patents on the editorial page of your magazine but in fairness to your readers we feel that we should point out to them that the "Power Saver" described in the August 1980 issue is subject to an Australian Patent. The Patent No. is 508,213 and was accepted on February 1, 1980.

Bin Anderson,  
Power Saver,  
Mermaid Beach, Qld.

**COMMENT:** As noted in the article, the power saver project was inspired initially by work done at NASA in the USA. Readers who plan to exploit the idea commercially may be well advised to check their position in relation to the above letter.

### Knotmeter

Ref "Knotmeter" letter from BH., Rotorua, NZ; October, 1980 — yes, there is a way to determine the speed of a boat or ship through the water using entirely electronic means.

AWA is (or was) the agent for a French firm called BEN of Marseilles — the BEN electromagnetic log works on the induction principle.

An electromagnet located under the hull generates a magnetic field in the surrounding water. When the ship moves, the field movement generates an electromotive force proportional to the water velocity relative to the field ie to the ship. A sensor generates a magnetic field and also picks up the electromotive force.

Another system using only electronic means is a Doppler log using the Doppler effect. This system can give speeds over both water and over ground. It gives speed over the water by using the water mass.

Both systems are rather complex electronically, and hence very expensive which makes them rather unsuitable for yachting.

C. F. Saroch  
CSIRO Division of Fisheries and  
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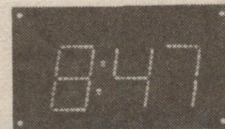
Front Panel . . . \$10.90  
Rack Mounting Case . . . \$55.00  
Wooden Sided Case . . . \$49.00  
ETI 471 PREAMP KIT of parts . . . \$45.00  
ETI 472 PS KIT of parts . . . \$47.00  
(without transformer) . . . \$24.00  
ETI 470 60W KIT of parts . . . \$26.50  
(without heatsink) . . . \$23.00  
ETI 480 50W KIT of parts . . . \$17.50  
ETI 480 100W KIT of parts . . . \$22.50  
ETI 084 Car Alarm KIT . . . \$11.50  
EA TV CRO ADAPTER KIT . . . \$29.00  
EA 300W POWER AMP MODULE . . . \$63.50  
ETI 466 300W PA MODULE . . . \$63.50  
EA DIGITAL CAPACITANCE METER KIT (EA March 1980) . . . \$52.99  
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MK3 Drill Speed Control . . . \$13.50  
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MUSICOLOR MK3 KIT . . . \$69.50  
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ETI 563 Nicad Fast Charger . . . \$54.90  
DREAM 6802 KIT . . . \$109.00  
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ETI 147 ELECTRONIC DUMMY LOAD KIT . . . \$99.00  
SERIES 3000 "MINI" STEREO AMP KIT . . . \$79.90  
ETI 561 Metal DETECTOR KIT . . . \$32.50  
PLAYMASTER 40+40 AMP KIT . . . \$129.00  
PLAYMASTER AM/FM TUNER KIT . . . \$129.00  
PLAYMASTER GRAPHIC EQUAL . . . \$99.50  
PLAYMASTER GRAPH ANALY KIT . . . \$99.50  
EA 79SF9 Sound Flash Trigger . . . \$15.00  
ETI 585H Ultra Sonic RX . . . \$15.95  
ETI 585T Ultra Sonic TX . . . \$8.95  
ETI 576 ELECTROMYOGRAM KIT . . . \$89.00

### ETI Digital Clock ETI 564

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Kit of parts

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### EA Power Saver

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For servicing and constructing electronics, when it comes to checking things out you need all the help you can get. LEADER

have the top reputation for precision and advanced, practical design.

When it comes to test gear—

when you want to get it right first time—and don't want to pay a fortune—look to LEADER. At Vicom, naturally.

# LEADER

## Top value gear for your test bench

### Leader's Signal Generator—

Range is 100 kHz to 100 MHz in five stages. It's the ideal RF signal generator for checking and aligning IF circuits and checking out tuners in AM, FM and TV receivers.

**LSG 16 \$143**



#### Frequency Range:

- (A) 100 kHz-320 kHz;
- (B) 320 kHz-1100 kHz;
- (C) 1.0 MHz-3.3 MHz;
- (D) 3.2 MHz-11 MHz;
- (E) 10 MHz-35 MHz;
- (F) 30 MHz-100 MHz;

**Harmonics:** 90 MHz-

300 MHz. **Accuracy:**  $\pm 1.5\%$

**Output:** 0.1 Vrms or higher to 100 MHz. **Modulation:** Internal: 1 kHz, External: 50 Hz to 20 kHz **Size and Weight:** 150(H) x 250(W) x 130(D). 2.5 kg approx.

### Leader's Audio Generator—

Range: 20 Hz to 200 kHz. Ideal audio generator for all types of circuits—from the most simple to complex hi-fi amplifiers. Large scale dial and easy to use operating controls.

**LAG 26 \$177**



**Frequency Range:** 20 Hz to 200 kHz in 4 stages. **Output:** 5 Vrms maximum. High, low and fine adjuster. **Size and Weight:** 150(H) x 250(W) x 130(D). 2.5 kg approx.

Lightweight, has easy to grip high impact handle and arc-over protection. Indispensable if you're working in TV servicing areas.

**Input impedance:** 20,000 ohms per volt **Range:** 40,000 volts **Accuracy:**  $\pm 3\%$  full scale. **Length & Weight:** 385 mm. 300 g approx.

### Leader's High Voltage Probe—

**LHM 80A \$43**



### Leader's Dip Meter—

**LDM 815 \$99**



Almost essential if you're into Ham, CB or other communications operation. Determines IC network frequency resonance and can be used to adjust wave traps, find parasitic oscillations and align receivers.

**Frequency Range:** 1.5 to 250 MHz in 6 bands. **Power supply:** 9V battery. **Oscillator:** Uses 1.15 MHz crystal. **Semiconductor complement:** 2 transistors and 1 diode. **Size and Weight:** 175(H) x 65(W) x 50(D). 0.5 kg approx.

Vicom International Pty. Ltd.

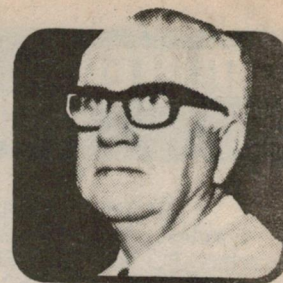
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# AMATEUR RADIO

by Pierce Healy, VK2APQ



## Amateur radio clubs — local and international

Amateur radio is one of the largest, if not the largest, international fraternities. It is a unique activity, born of both technical curiosity and a desire for personal communication between different nationalities and cultures.

Throughout the world there are amateur radio associations, societies, clubs, groups or such, bringing together those forming this unique technical and social brotherhood. Formed at a local, parochial, or international level, they foster the exchange of knowledge in radio technology and varying degrees of community service. Such bodies play a vital part in the lives of millions of people.

In fact, the experimental work of amateurs in bygone decades was the starting point for the development of the world-wide communication services and entertainment facilities available today.

Some of these facilities were the work of dedicated groups or clubs. One example is the establishment of two-metre repeaters which, in times of disaster, can provide vital communications over otherwise impossible paths.

In past years, a radio club directory was published this month as an aid to amateurs travelling during the Christmas-New Year holiday period, who wished to contact fellow amateurs in areas visited.

However, with the widespread installation of FM repeaters in the two-metre band, coupled with the proliferation of handheld and mobile equipment, it seems that a more direct and up to the minute information source is now available.

In fact there are few coastal areas from Port Pirie SA to Cairns Qld where portable or mobile operation through a repeater is not available. In addition inland areas of Victoria and New South Wales are well catered for. Likewise there are repeaters operating in Perth, Albany, Geraldton and Kalgoorlie WA; Canberra ACT; Darwin and Alice Springs NT; Hobart and north coast Tasmania.

In general the repeater installations have been provided and maintained by clubs in nearby areas. A listing of these

repeaters is being prepared for inclusion in future notes.

Instead of the directory this month, there is a list of radio clubs who have regularly supplied information about their activities. Most have repeaters and also hold instructional classes for those wishing to study for an amateur licence. Further information may be obtained direct from the clubs.

Call signs are given, as most clubs hold nets at times to suit members and the repeater (R) call signs given are for the repeaters licensed through the respective clubs.

### AUSTRALIAN CAPITAL TERRITORY

- ACT Division WIA, Inc: Secretary, PO Box 46, Canberra 2600. VK1WI, VK1RAC, VK1RGI.

### NEW SOUTH WALES

- Australian National Amateur Radio Teleprinter Society: Secretary, PO Box 860, Crows Nest 2065.
- Blue Mountains Amateur Radio Club: Secretary, PO Box 54, Springwood 2777. VK2AUX, VK2NCM.
- Central Coast Amateur Radio Club: Secretary, PO Box 238, Gosford 2250. VK2AFY, VK2RAG.
- Crestwood Amateur Radio Club: Secretary, 16 Turon Avenue, Baulkham Hills 2135. VK2BFZ.
- Hunter Branch WIA: Secretary, 49 Valud Crescent, Highfields 2289. VK2AUX, VK2RAN.
- Illawara Amateur Radio Society: Secretary, PO Box 1838, Wollongong 2500. VK2AMW, VK2RAW.
- Jesmond and Districts Electronics and Communication Club: Secretary, John Murphy, at clubrooms rear of Regal Theatre, Moore Street, Birmingham Gardens, Saturdays 1pm to 5pm. VK2BHZ.
- Liverpool and District Amateur Radio

Club: Secretary, 105 Willan Drive, Cartwright 2168. VK2AZD.

- Mid South Coast Amateur Radio Club: Secretary, PO Box 113, Milton 2536. VK2RMU.

- Museum of Applied Arts and Sciences Amateur Radio Club: Secretary MAASARC, 659-695 Harris Street, Broadway 2007. VK2BQK.

- St George Amateur Radio Society: Secretary, PO Box 77, Penshurst 2222. VK2LE, VK2RLE.

- Westlakes Radio Club: Secretary, PO Box 1, Teralba 2284. VK2ATZ, VK2RWR.

- Wagga Amateur Radio Club: Secretary, PO Box 71, Koorngal 2650. VK2WG, VK2RWG.

- Coffs Harbour and District Amateur Radio Club: Secretary, PO Box 655, Coffs Harbour 2450.

### VICTORIA

- Eastern and Mountain District Radio Club: Secretary, PO Box 87, Mitcham 3220. VK3ER, VK3BNW.

- Geelong Amateur Radio Club: Secretary, PO Box 520, Geelong 3220. VK3ATL, VK3RGL.

- Geelong Radio and Electronics Society: Secretary, PO Box 962, Geelong 3220. VK3ANR.

- Moorabbin and District Radio Club: Secretary, PO Box 88, East Bentleigh 3165. VK3APC.

- Eastern Zone Vic Div WIA: Secretary PO Box 339, Moe 3825. VK3REG, VK3RLV.

- Gippsland Gate Radio Club: Secretary, PO Box 98, Dandenong 3175. VK3BJA.

- Southern Peninsula Amateur Radio Club: Secretary, 7 Spensley Street, Rosebud 3939. VK3BSP, VK3VKR.

### QUEENSLAND

- Brisbane VHF Group: Secretary, PO Box 911, Fortitude Valley, Brisbane 4006.

- Bundaberg Amateur Radio Club: Secretary, PO Box 129, Bundaberg 4670.

- South East Queensland Teletype Group: Secretary, PO Box 274, Sunnyside 4109. VK4TTY.

- Gold Coast Amateur Radio Society: Secretary, PO Box 588, Southport 4215. VK4WIG, VK4RGC.

- Townsville Amateur Radio Club: Secretary, PO Box 964, Townsville 4810.



# AMATEUR RADIO

## SOUTH AUSTRALIA

- Wireless Institute SA Division: Secretary, PO Box 1234, GPO Adelaide 5001. VK5WI, VK5RAD, VK5RHO, VK5RMN.
- Lower Eyre Peninsula Radio Club: Secretary, PO Box 937, Port Lincoln 6506. VK5ALE.
- South East Radio Group: Secretary, PO Box 1103, Mount Gambier 5290. VK5RMG.

## WESTERN AUSTRALIA

- The West Australian VHF Group Inc: Secretary, PO Box 189, Applecross 6153. VK6WH, VK6RAH, VK6RAP.

## TASMANIA

- North West Branch Tasmanian Div WIA: Secretary, PO Box 194, Penguin 7316. VK7NW, VK7RNW.

## NORTHERN TERRITORY

- Alice Springs Community College Radio Club: Secretary, PO Box 2935, Alice Springs 5750. VK8AR, VK8RCA.
- Darwin Amateur Radio Club: Secretary, PO Box 37317, Winnellie 5798. VK8DA.

Of course there are many more radio clubs throughout Australia. Some may be parochial in nature, but they provide

a meeting point for small groups interested in a particular phase of electronics, or just a localised area, some even shunning publicity. All have a place in amateur radio activity.

For personal reasons, some amateurs are content to belong to a local club, in preference to the national society. While individuals are free to make this choice, it does not enhance the status of the national society. It is a political fact that it is only through national societies combining in the International Amateur Radio Union that amateur radio is held in such high regard by the International Telecommunication Union. It is through national societies that the amateur point of view will have the greatest impact on government departments.

Irrespective of personal prejudices, direct support for national societies is the effective method of ensuring that our status remains high in the eyes of legislative authorities.

Here are brief details of a few national amateur radio societies. Although appearing last in alphabetical order, the Wireless Institute of Australia is the oldest national amateur radio society in the world, founded 1910.

- International Amateur Radio Union: PO Box AAA, Newington, Connecticut 06111, USA.
- American Radio Relay League: 225 Mann Street, Newington, Connecticut, 06111, USA.
- Amateur Radio Society of India: PO

Box 534, New Delhi 1, India.

- Federation of Amateur Radio Societies of India: Madras 600-008, India.
- Japan Amateur Radio League: PO Box 377, Tokyo Central.
- New Zealand Association of Radio Transmitters Inc: 15 Field Street, Upper Hutt, NZ.
- Radio Society of Great Britain: 35 Doughty Street, London WC1N 2AE.
- Wireless Institute of Australia: Federal Executive, PO Box 150, Toorak, Vic 3142. ACT Division: PO Box 46, Canberra 2600. NSW Division: PO Box 123, St Leonards 2065. Vic Division: 412 Brunswick Street, Fitzroy 3065. QLD Division: GPO Box 638 Brisbane 4001. SA Division: GPO Box 1234, Adelaide 5001. WA Division: GPO Box N1002, Perth 6001. Tas Division: PO Box 1010 Launceston 7250.

## NATIONAL FIELD WEEKEND

The Geelong Amateur Radio Club has accepted the challenge to co-ordinate a nationally publicised VHF field weekend.

The aim is to encourage VHF/UHF participation in the Ross Hull Contest, as well as filling the need for a nationally co-ordinated VHF field weekend.

Contest period: Any continuous 24 hour period within the first 48 hours of the Ross Hull Contest which commences December 6, 1980.

Rules: Ross Hull Contest rules apply with the following exceptions: Only entries from portable stations will be accepted, but check logs from home stations will be welcome. A station is deemed portable when operated at least 2km from home location. No equipment, including antennas, may be set up more than 24 hours prior to the start of the contest. Power may be derived from any source available. A scoring contact may be made with the same station on the same band repeatedly, provided at least four hours elapse between contacts.

Scoring: As per the Ross Hull contest rules. (Note: Details of the Ross Hull contest were not available when these notes were compiled. However, they will be available through WIA sources at the time of this field day.)

Entries: Each entry must contain a front sheet giving details of station, including location and total score claimed, plus a photo copy of the log.

All entries will be acknowledged, and certificates will be awarded to the overall winner plus the highest score in each call area.

All entries to: "Contest Manager", Geelong Amateur Radio Club, PO Box 520, Geelong 3220.

## ITU NEWS

The United Nations Economic and Social Council has nominated the International Telecommunication Union (ITU) to lead the preparations for a proposed World Communications Year. The year foreseen is 1983.

World Communications Year is intended to provide an opportunity for all countries to undertake an indepth

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|---------------------------------|--|
| 1. Nominal Frequency            | 32.768KHz  |
| 2. Frequency Tolerance          | $\pm 30\text{ppm}/28^\circ \pm 1^\circ\text{C}$              |
| 3. Drive Level                  | 1 $\mu\text{W}$ max  |
| 4. Series Resistance            | 31.0k ohms max   |
| 5. Q Factor                     | 40000 min  |
| 6. Parabolic Curvature Constant | Less than $-0.04\text{ppm}/^\circ\text{C}$<br>(Refer Fib. 1) |
| 7. Turnover Temperature         | $28.0^\circ\text{C} \pm 5^\circ\text{C}$                     |
| 8. Capacitance Ratio            | 700 max  |
| 9. Storage temperature Range    | $-30^\circ\text{C} \sim +80^\circ\text{C}$                   |
| 10. Operating Temperature Range | $-10^\circ\text{C} \sim +60^\circ\text{C}$                   |
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| 12. Shock                       | Less than 5ppm for 50cm<br>Hammer Shock Test                 |
| 13. Package size.               |  |



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## NEW YAESU FRG 7700

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**and it's CHEAPER!!**

First the incredibly popular FRG-7. Then the FRG-7000. Now a brilliant new all mode, general coverage receiver with all the features the keen amateur or short wave listener really needs.

Digital Display — reading from 150kHz to 30MHz! This also doubles as a highly accurate crystal controlled clock.

Wide dynamic range. Selectable AGC. All mode (including FM and 3 widths of AM). Optional twelve memory channels with backup. A remarkable piece of solid state engineering — and it is actually cheaper than the FRG-7000 (and many other 'similar' receivers on the market). Ask to see one soon at your nearest Dick Smith store or reseller. . . . . Magnificent!



Cat. D-2840

Freight \$6

Below cost anywhere in Aust.

**\$525**

OR FROM \$55 DEPOSIT AND \$25.74/MONTH (24 MONTHS)

Memory Unit extra



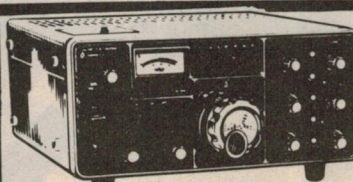
**\$543<sup>00</sup>**

OR FROM \$63 DEPOSIT AND \$26.28/MONTH (24 MONTHS)

### NEW FT480

- All mode 2 metre SSB/CW/FM!
- Microprocessor controlled
- Digital display!
- 30 watts PEP

This is the one they're all talking about: the fabulous new 2 metre all-mode transceiver from Yaesu. Offering outstanding performance and ease of controls, it must be the transceiver of the eighties! Cat D-2887



### SAVE ON FT625!

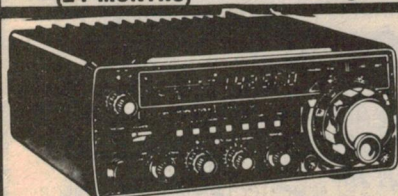
**ALL MODE 6M**

**WAS \$795.00 . . NOW ONLY**

**\$695<sup>00</sup>**

OR FROM \$75 DEPOSIT AND \$20.48/MONTH (48 MONTHS)

We've knocked an incredible \$100 off the price of these popular all-mode 6 metre rigs. There's still plenty of good DX out there on 6 — and the FT-625 is just the transceiver to get it! Cat D-2886



**\$765<sup>00</sup>**

OR FROM \$85 DEPOSIT AND \$22.86/MONTH (48 MONTHS)

### NEW FT707

- All HF bands!
- AM/SSB/CW!
- Tiny Size!
- True digital display
- New WARC bands!

They've been pretty hard to get, and small wonder! The superb FT-707 packs a huge punch from its tiny size: 240W DC! It's the ideal rig for mobile, base or portable work. Cat D-2869

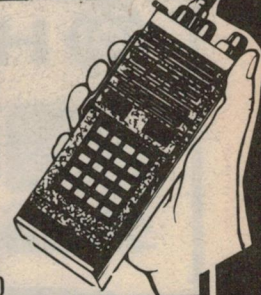
### SUPERB FT-207

- Microprocessor controlled hand held giving full 144-148 band!
- Digital display.

**\$358<sup>00</sup>**

Cat D-2888  
OR FROM \$38 DEPOSIT AND \$17.52/MONTH (24 MONTHS)

For today's active ham, this is the set to take with you. Takes up virtually no room, but really gets out! Make contacts wherever you go with the FT-207R.



**\$1278<sup>00</sup>**

OR FROM \$138 DEPOSIT AND \$38.32/MONTH (48 MONTHS)

### NEW FT107M

- The ultimate!
- WARC bands
- All solid state
- Variable IF bandwidth!
- Speech proc.

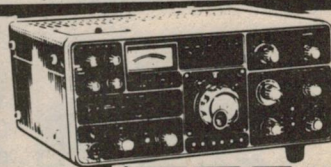
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We throw in a digital display kit worth over \$100! This turns the FT-101Z into an FT-101ZD!

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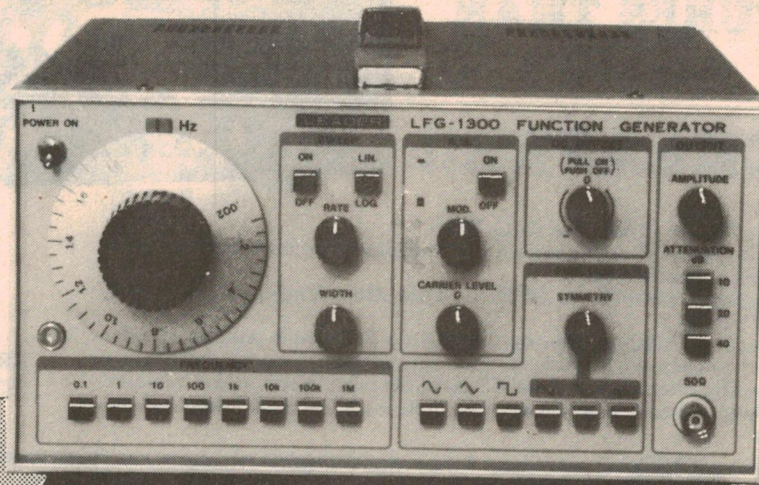


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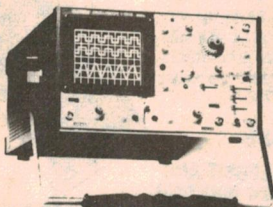
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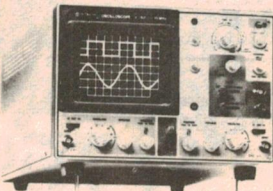
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### V550 50 MHz

**\$1,795**

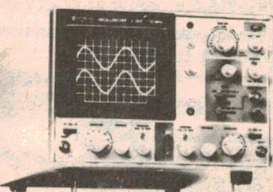
Professional quality oscilloscope with many unique usable features: 50 MHz Dual Trace, Third Trace Trigger View, 1 mV/Div. Sensitivity, Delayed Sweep, X10 Sweep Magnification. Equivalent Oscilloscopes cost 100s of dollars more. Supplied under contract to the A.B.C.



### V302 30 MHz

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### V152 15 MHz

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Dual Trace 15 MHz, 1 mV Sensitivity, XY operation, TV sync separator circuit. Sweep times magnifier (10 times) Trace rotation Z Axis Input. Excellent value for money. Supplied to many Government Departments and National TV Service Companies.

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G.B. Telespares, Teleparts, David Reid Electronics, EQC Electronics.  
**Qld.** Audiotronics, ECQ Electronics,  
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# AMATEUR RADIO

review and analysis of their policies on communication development and to stimulate accelerated development of their infrastructures, according to their priorities.

The last decade has witnessed tremendous advances in telecommunications, as well as the adoption of other techniques, to facilitate high speed/low cost transfer of information, data, recorded message, video, broadcasting, television, two-way voice communications, etc.

There has been growing recognition of the communications infrastructure as a key factor in the social and economic development and equally between and within nations.

Because amateur radio played a major role in the development of radio communication, it is thought that amateur operators should contribute something towards World Communications Year activities.

In that regard a proposal is being considered by the Australian National Amateur Radio Teleprinter Society to sponsor world-wide activity among amateur radio teletype operators, in keeping with the aims of the International Telecommunication Union.

## AMATEUR SATELLITE NEWS

The next candidate for the title of AMSAT-OSCAR IX is the UOSAT currently under construction as a joint AMSAT-UK-University of Surrey project at the University of Surrey in England. UOSAT is, at this time, scheduled for launch aboard a Delta vehicle as a secondary payload on the solar mesosphere explores mission, in September, 1981.

This spacecraft is the first amateur scientific satellite and does not contain a communications transponder.

It is aimed at the AMSAT educational program and as a tool for serious scientific study of radio propagation phenomena. The spacecraft will be put into a sun-synchronous orbit with an altitude of 530km, at an inclination of 97.53°. The sun-synchronous orbit will have a 3pm descending node, that is, its descending node overhead pass will always occur at about 3pm. The period of orbit is 98 minutes.

UOSAT will contain coherent beacons in the 7, 14, 21, and 28MHz bands as well as VHF/UHF beacons in the 145, 435MHz and 2.4 and 10.47GHz bands. The spacecraft will be controlled by an on board integrated housekeeping unit (IHU) built around an 1802 microprocessor. UOSAT will also carry three experiments, namely a particle detector, a magnetometer and a slow-scan TV camera.

An integrated circuit manufactured by ITT, designed for speaking clocks, is being evaluated for suitability in generating speech telemetry. The integrated circuit has capability to generate numbers from 1 to 59, and versions are available in English, French and German. Should the device prove suitable, the spacecraft will be sending back telemetry as plain language voice signals.

The telemetry is planned to be transmitted in the following formats and rates:— ASCII — 1200, 600, 300, 110 bauds; Baudot 50 bauds; Morse code 10wpm and voice.

The slow-scan TV signals will be transmitted in digital format, rather than conventional analog SSTV, because the camera is digital, based on charge-coupled devices. The data is designed to be put into a computer and/or displayed on a fast scan or regular TV monitor, which requires digital storage of the data.

With the launch of this spacecraft, a new realm of experimentation will open up for the radio amateur.

(Acknowledgment: AMSAT publication, ORBIT September/October 1980, Vol. 1 No. 3.)

## CENTRAL COAST FIELD DAY

The Central Coast Amateur Radio Club will hold their 24th annual field day on Sunday, February 24, 1981. The venue will be the Gosford Showground.

There will be events for all the family. Why not make it a weekend on the beautiful central coast? Accommodation should be booked well in advance. Do it now and enjoy this event which caters for the most ardent amateur radio enthusiast as well as being a family gathering.

Further details in future notes.

## RADIOTELETYPE NEWS

Number 1 RTTY DXCC certificate has been issued to Syd Molen, VK2SG by the WIA awards manager.

The award is for working and receiving QSL card confirmation from 100 different countries for contacts on radio teletype.

Syd says he was not the first to make this achievement, but was the first to apply for the award.

Besides working DX, Syd's activities include the preparation and transmission of RTTY news broadcasts. These are made on behalf of the Australian National Amateur Radio Teleprinter Society each Sunday at 0030 UTC on 7045kHz and 14090kHz; 21095kHz at 0130 UTC and 3545kHz at 0930 UTC. Relays of the transmissions are made on 146.6MHz at 0030 UTC and 0930 UTC.

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Radio clubs and other organisations, as well as individual amateur operators, are invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown.

# U.H.F.

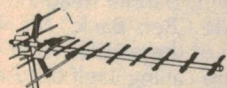
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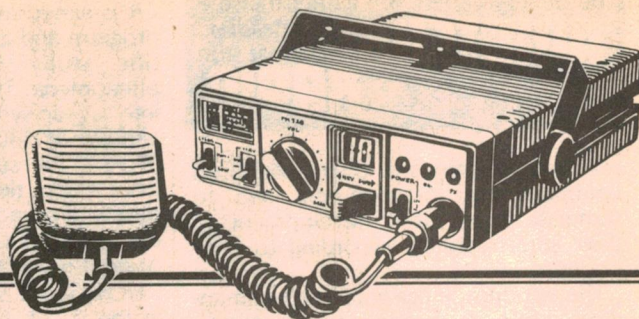
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**P.O. BOX 123,**  
**ST. LEONARDS, NSW 2065**



# The Australian CB SCENE



## CBRS INQUIRY: Interim report released

The Working Group conducting an inquiry into the CBRS has released its interim report, which indicates that the 27MHz CB band is to be retained until at least 1990. A more comprehensive report will follow at a later date, giving the opportunity for further public comment.

The NCRA has already formulated and submitted a response to the interim report, expressing satisfaction with some of the recommendations but drawing attention to other matters which they feel should be considered further.

Debate will undoubtedly continue both before and after the release of the more comprehensive document.

Because release of the report came at an awkward time, relative to the deadlines for this issue, I am not able to comment at length. However, the recommendations of the interim report are summarised below:

1. The interim report be issued immediately "to allay public conjecture", particularly as to the future of 27MHz CB.
2. Both 27MHz and 477MHz CBRS be retained beyond 1982. At this stage 930 MHz CBRS has not been assessed.
3. 27MHz CBRS be retained to 1990, when it would be subject to the normal periodic review which applies to all services.
4. Retention of the 27MHz be conditional on "strict control and minimisation of those factors contributing to interference".
5. CBRS be reaffirmed as "a short distance radio service for use within the geographical limits of Australia".
6. Consideration be given to increasing the number of channels for 27MHz CBRS. The changes could possibly be initiated in 1982.
7. Calling and emergency channels be specified as such by legislation.
8. Automatic transmitter identification signal (ATIS) be included in the specifications for future CBRS equipment, subject to technical feasibility. This would help reduce unlicensed operation.
9. Powers to deal with irresponsible operation (hoax calls, jamming, obscenities, etc) be increased. The adoption of ATIS would serve as a further discipline.

To change the subject, it appeared for a while that another National CB organisation was on the move, in the form of the Australian Association of Citizens and Band Radio Operators, based in South Australia. This caused considerable comment. Indeed, it is always good to see any initiative which might help push the cause of the CB operators.

However, further information would suggest that it was a fairly tentative move. I sincerely hope that this is not the case, and would extend an invitation to anyone associated with the group to contact me with more information.

### Mail Bag

**ACRM (SA).** A couple of days after I had sent in my copy for the last issue, I received a letter from Mr G. H. Tucker, the Public Relations Officer for the Australian Citizens Radio Monitors (South Australian Branch). I must admit that ACRM is more widespread than I had thought. Apparently the SA Branch is the "parent" body, but ACRM now has divisions in SA, WA, Qld, NSW and the Northern Territory.

The main difference between ACRM and, say, CREST, is that each division is free to operate without "head office" supervision, although any request for help from the divisions is promptly dealt with. In the last issue (Nov) I told you about the Queensland division of ACRM. The aims and objectives of both bodies are, of course, the same.

If any of my readers would like more information regarding ACRM and/or how to go about setting up a division of the organisation, you can write to Mr Tucker at ACRM, SA Branch, PO Box 83, Prospect, SA 5082.

It is great to be receiving feedback from the monitoring groups, and I am only too glad to be of assistance by letting the rest of Australia know about your activities. Keep up the good work.

**From Omega 1.** My good friend Ken Upton, the Omega 1, has written in again, with more interesting news. If this keeps up, Ken, I'll have to ask the Editor for a pay-rise so that I can put you on my payroll!

Ken, Shirley, Sharlene and Janelle Upton went to the Orange Blossom Festival. While his wife and daughters were watching the parade, Ken visited the Castle Hill Community Centre and had a look at the VK-CB Club's radio display, meeting Sam Voron and the rest of the gang. Apparently the display was quite impressive. Ken also dropped in on the Lidcombe Hospital Fete and found the Lakemba Area (LA) CB Club members there in strength helping with traffic and the stalls.

Ken also made mention of a Blood Bank Appeal which was organised by John Marr Communications in Blacktown from September 29 through October 3. It seems that John arranged with other local stores to give discounts to anyone who gave blood during the appeal. Ken's own club, the Omega CB Club was there in force, and I understand that it was a great success. That's great news, and I offer my sincere congratulations to you all.

One wonders where Ken is going to pop up next.

**Brickbats and Bouquets.** From Des Smith of The Basin, Victoria, comes two letters, one dealing with a newspaper report dated September 4 referring to "renegade" CB operators, and the second an editorial from the same newspaper which appeared two weeks later.

"The Sun Easterly" (Victoria) Supplement of Thursday September 4th last, carried the following banner headline on page 1: "Renegade CBers Back." Mr Neil Reed, the author of the article, went on to say that a group calling itself the Anti-Citizens' Band Organisation had been operating in the outer eastern suburbs of Melbourne for about the past five years, and were allegedly guilty of using foul language and initiating hoax calls. The P&T were having trouble tracking them down.

The reaction from CB clubs was immediate and the "Easterly" gave them almost half a page for their replies in the



issue of September 18. I gather that the replies were grouped under the heading: "The real renegades hit back at the hoaxers".

The heading seems a curious one but it was certainly unfortunate because there is a legitimate CB Club in the eastern suburbs called the "Renegade CB Club." Instead of going off the deep end as one would understandably expect the club to do, it simply voiced its disapproval of the activities of the anti-CB group and expressed the hope that the club would be in no way associated with the hoaxers. A model of restraint, indeed.

Then followed letters from the Whisky Mike Club, the Breaker Group, the Region Dandenong Club, and the Noble Cavalier Club.

Each of these clubs informed the "Easterly" of their own fund raising drives in aid of charities, and of other community work which they are engaged in. Through their efforts, and the responsibility shown by the editorial staff of the "Sun Easterly", the readers of that newspaper were given the opportunity to see both sides of the story.

And, thanks to Des Smith, I was able to pass it on to you.

It underlines what we tend to forget when we come across items that are deliberately — or even accidentally — unfair to CB. We should take the trouble to set the record straight. CBers may know that certain items are wrong, but other readers may not.

### National Emergency Group

I note with pleasure that a National Emergency Group Council has been formed. The name of the Council is the Citizens Radio Emergency Monitors' Council (CREMC) and it is made up of all the monitoring groups throughout Australia. I am not sure about all the relevant details but, if anyone would like more information, you can contact the National Co-ordinator, Mr Len Duke at CREMC, PO Box 268, Footscray West, Victoria, 3012.

I am hoping to receive information direct from Len regarding the Council, and will pass it on as soon as time and space allow. Apparently, the initial funding of the Council is being undertaken by both CREST and Redlight. My congratulations to both those organisations, and to everyone else associated with the concept.

It is hoped that, with the advent of the Council, and the closer working ties between all the monitoring groups associated with it, past bitchiness and disharmony will disappear from the Emergency frequencies. Good luck to you all.

Well, that's about it for this month, and this year. As always, send any news to me at PO Box 406, FORTITUDE VALLEY, 4006, and until next issue, please look after yourselves and have a merry Christmas and a Happy New Year.

Jan Christensen.



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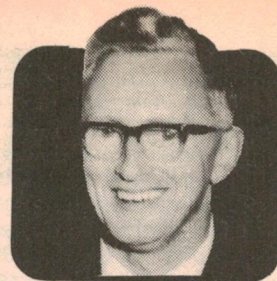
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# SHORTWAVE SCENE

by Arthur Cushen, MBE



## Radio Lesotho has new 100kW transmitters

New transmitting facilities were opened recently in Lesotho (near South Africa) and two transmitters, each of 100kW, are now in action. One transmitter is operating on the medium-wave frequency of 891kHz, while the other operates on 4800kHz shortwave.

Broadcasting from studios in Maseru, Radio Lesotho was noted from September 26 with its new stronger signal. It is now using 100kW from transmitters that were a gift from the British Government.

The best reception has been from 1800 to past 2000UTC when broadcasts are in SeSotho, and this includes comments at 1830UTC of world news. Chris Martin of Sydney advises that the schedule is 0400-0700, 1100-1200 and 1500-2100UTC. During the opening of the station it was reported that the British Government had also been asked to look at the possibility of television in Lesotho.

According to the World Radio & Television Handbook, Radio Lesotho operates 0400-2030UTC with an extension to 2105UTC on Wednesday and Sunday. It is obvious that as soon as the new shortwave transmitter is finished its test period, it will be used to carry a full day's transmission.

The address of the station is Lesotho National Broadcasting Service, PO Box MS552, Maseru, Lesotho.

### LATIN AMERICAN SIGNALS

Interesting signals from Latin America have been heard during the late evening listening in this area and Steven Greenyer of Invercargill, NZ reports the reception of a new station in Chile, Radio Patagonia. This newcomer to shortwave operates on 6080kHz and opens at 1029UTC with chimes and theme music. It then follows with station identification, which gives the medium-

wave transmission as CD97 from Coyhaique.

Broadcasts from the Bluefield station in Nicaragua have been observed opening at 1100UTC on 6120kHz. The opening announcement is in Spanish and English and reception is better on Mondays when the Argentine station is not using the frequency.

An out-of-band station in Argentine, Radio Rivadavia in Buenos Aires has been heard opening at 1000UTC on 5882kHz. A signal seldom reported from Honduras is Radio Landia, Comayagua, which operates on 4965kHz and has been observed at 1200UTC opening transmission with a detailed announcement in Spanish.

### AIR DX PROGRAM

Another country to commence a DX program is India and All India Radio now has a session on the first and third Monday of each month. The broadcast is heard at 1040UTC in this area during the transmission to Australia and New Zealand, with the best reception on 15205 and 15285kHz.

The new program has been made possible by the co-operation of Alok Das Gupta with All India Radio officials, and this should ensure an excellent session of news from the Asian area. Alok Das Gupta has been associated with DXing for many years and is a Technical Monitor for several international stations as well as a founder of the Indian DX Club, and a former Editor of DX Digest.

### FREQUENCY CHANGE

Radiofonica Populares at Riobamba, Ecuador has verified our reception of their broadcast on 3985kHz. According to the station they will change frequency during January to 5015kHz. The power is listed as 1kW and broadcasts were noted at 1015UTC.

This station is an educational and cultural broadcaster and verifies with a card illustrating the educational programming of the station. Radiofonica Populares has the mailing address of Casillas, 4755, Riobamba, 6316 Ecuador.

### IRAQ-IRAN CONFLICT

The battle of words between Iraq and Iran has been followed by shortwave listeners everywhere. Broadcasts are from Baghdad on 9745kHz at 2130UTC and from Tehran on 9022kHz at 1930UTC with their English program.

Both countries have announced extensive plans to increase their shortwave facilities and, according to the BBC Monitoring Service, Iran is to purchase eight shortwave transmitters and 18 aerials for external broadcast. In a report from Baghdad, it was stated that Iraq had signed contracts to a value of about \$162 million with a French company to carry out projects concerning shortwave radio transmissions. The announcement stated that the projects were to be completed in 22 months and would help to bring the programs of Radio Baghdad and the Voice of the Masses to parts of the world which do not yet receive them.

### HANDBOOK REVISED

The 1981 World Radio & Television Handbook is to be completely revised and is to be printed in the United States for the first time. Over the years the publication has been printed in Denmark, and later in the United Kingdom. The 1981 edition, the 35th, is to be produced in Philadelphia.

As well as a complete directory of all the world's radio and television stations, the 1981 edition will include the popular feature "Listen to the World" in which Larry Magne will again review some of the world's leading portable receivers. As it is the International Year of the Disabled person in 1981 there will be special articles on the subject of "Listening for the Disabled", including one by the writer.

Other subjects will include: the 60-metre band compiled by Carol Feil

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing daylight time, add a further hour.



## SHORTWAVE SCENE

and Anker Petersen of the DSWCI; Victor Goonetilleke on DX-ing in the Developing Countries; and Michael Willis on listening to China.

The fact that the handbook is being printed in the United States will mean that copies will be available sooner than otherwise in the South Pacific area. The first airmail copies should be available by early February, but it will be at least April before they reach the bookstores. Readers can obtain further information by writing to Arthur Cushen, 212 Earn St, Invercargill, NZ.

### NEW PHILIPPINES SIGNAL

An interesting signal from the Philippines has been noted on the out-of-band frequency of 6245kHz, with full station identification heard at 0940UTC. This station has been widely heard in New Zealand and reporters to the "New Zealand DX Times" give the slogan as "Radio One, Department of Public Information". The station announces in English and plays rock music with a news bulletin at 1000UTC.

Announcements indicate that medium-wave 738kHz and shortwave 3286kHz carry the same program.

### RADIO RENASCENCA

Radio Renascenca, the radio station run by the Catholic Church for Portuguese speaking emigrants in Europe, currently broadcasts daily from 1500-1530UTC on 9670kHz through facilities provided by Radio Trans-Europe. The Lisbon station has reported that plans are being made for new medium and shortwave transmitters to improve reception. Some 25 years ago Radio Renascenca was frequently heard on shortwave when they used 6155kHz with a power of 7kW.

### NEW MORNING SERVICE

Radio Canada International has altered its transmission of the DX Digest program so that it can be heard in Australia and New Zealand on Sunday morning instead of Monday morning as in the past. The 25 minute program is broadcast at 2135UTC on 11945, 15150 and 17820kHz and though beamed to Africa, is timed to give good reception in the South Pacific.

Radio Canada International, Montreal, on Saturdays and Sundays has combined its 1900-1930UTC and 2000-2030UTC English and 1930-2000UTC and 2030-2100UTC French broadcasts into two 1-hour programs. The English program is broadcast from 1900-2000UTC and the French from 2000-2100UTC. Both are heard on 5995, 7130, 15325, 17875 and 21695kHz.

## LISTENING BRIEFS

### Europe

**ANDORRA:** Radio Andorra has been heard with Adventist World Radio Programs on 15028kHz on Sunday at 0900UTC. At 0930UTC a DX program is heard, but this frequency suffers some adjacent interference from Radio Peking on 15030kHz. The broadcast is carried on the new 10kW transmitter.

### Africa

**LIBERIA:** Station ELBC on 3255kHz has been heard with a program of instrumental music at 2142UTC according to David Foster and Geoff Cosier of Melbourne.

### Asia

**INDIA:** All India Radio is broadcasting in English to Australia and New Zealand using the new frequency of 15285kHz 1000-1100UTC. The signal is relatively poor in this area, and 15205kHz still provides the best reception. The other frequency of 17875kHz is also received at good strength.

**PAKISTAN:** Radio Pakistan has recently replaced 21590 with 21595kHz and is heard at 0915UTC opening in Tamil. English news at slow speed is broadcast 0230-0245UTC on 17835, 21590 and 21745kHz. English news to Europe is on 17665 and 21655kHz at 1100-1115UTC, both frequencies providing good reception.

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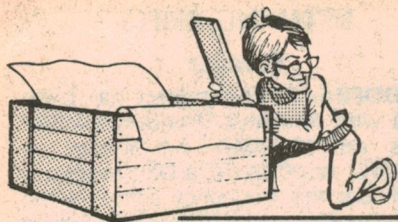
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# NEW PRODUCTS

## Application BS-610 15MHz Dual Trace Oscilloscope

Competition in the market for medium price oscilloscopes is very intense in Australia. Entering this hotly contested area is the Application range of oscilloscopes, of which the model BS-610 dual trace, 15MHz oscilloscope is representative. It has all-solid-state circuitry and low power consumption.

Overall dimensions of the Application BS-610 are 280 x 145 x 369mm (W x H x D) including knobs, feet and rear projections while the mass is close to 7kg. The unit has a large carrying handle which also functions as a tilting bail. The CRT is rectangular with a nominal diagonal measurement of 140mm, although the actual measurement is closer to 130mm. The CRT phosphor is blue.

The internal graticule is divided in the usual way, with ten horizontal and eight vertical divisions. Each division is slightly less than ten millimetres.

All of the usual facilities and controls are provided, as may be expected for this grade of instrument. The vertical amplifiers and their attenuators are fully calibrated, along with the timebase settings. The vertical attenuators are stepped 1-2-5, from 10V per division to 5mV per division. The timebase has settings available from 0.5s per division to 0.5µs per division. X-Y operation is also provided for on the timebase switching.

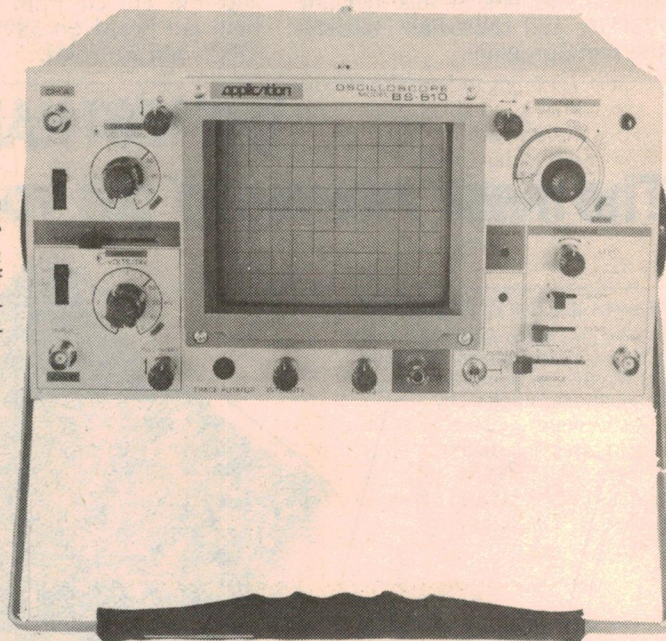
A novel but useful feature on the front panel is the Trace rotator which allows precise levelling of the trace without any need to gain access to the inside of the instrument.

Comprehensive triggering facilities are provided with the most useful feature which is labelled "INT". This allows each trace to be synchronised from its associated channel input which allows both trace patterns to be stationary even though the input signal frequencies may not be harmonically related. At the same time, there is also the usual facility whereby both traces may be synchronised from either channel input.

We checked the vertical input impedance as being 1M and the shunt capacity as 20pF. The bandwidth on the AC setting was measured as from below 3Hz to 18MHz at -3dB. Checked against known reference frequencies, the timebase calibrations were accurate. Under dual trace conditions, in the range from 0.5s per division to 1ms per division, both channels are switched at about 100kHz and in the rest of the ranges, each channel is switched alternately.

As may be seen from the photograph, the front panel layout is somewhat different from a good few other oscilloscopes on the market, in that the CRT is centrally located and the panel is wider and not so high. This has produced a very tidy internal layout but the resulting ergonomics of the left hand side of the panel are not so satisfactory. This is because the input cable for Channel A interferes with the operator's access to the relevant controls, particularly the AC/GND/DC selector switches.

*The Application BS-610 dual trace oscilloscope has a bandwidth of 15MHz and comprehensive triggering facilities.*



As noted above the internal layout of the BS-610 is clean, tidy and uncluttered. The majority of the components are distributed over three boards. The power supply unit is located on the bottom of the case and underneath the tube assembly. The Horizontal/Timebase unit is located on the right hand side of the case and close to the relevant front panel controls. The vertical amplifier unit is located on the left hand side of the case, also close to the relevant front panel controls. The mains transformer is mounted on a bracket on the back panel

of the case. The transformer includes a copper strap and the CRT is also protected with a magnetic shield.

The BS-610 power supply allows the unit to be operated from a DC source of between 11.5 and 30V, with a power consumption of 11VA, which is quite modest. This versatility is extended to AC operation as it may be used on 90 to 130V in one switch position and 180 to 260V in the other switch position.

A comprehensive user's manual is supplied with the oscilloscope and gives details of controls, functions and operating procedures.

Our overall impression of the Model BS-610 oscilloscope is that it is very well designed and built and it does what the makers claim for it. Mechanically it is also well made and finished. The recom-

mended price is \$585.00 plus tax (\$672.75) and is of the order which one might expect for this line of instrument. No probes are included but a variety of suitable probes are offered and the customer is able to select to suit his particular purpose. Prices range from \$15 to \$40 plus tax.

Further information on the BS-610 may be obtained from Elmeasco Instruments Pty Ltd, PO Box 30, Concord, NSW 2137, Phone (02) 736 2888; or PO Box 107, Mt Waverley, Victoria 3149, Phone (03) 233 4044. (I.L.P.)



# Replay PAL, NTSC, SECAM video tapes — VHS or BETA

The National VHS  
video cassette  
recorder  
NV-8600-EM handles  
three modes on  
playback, two on  
record.



Readers who have access to video cassettes from overseas may be interested to know that decks are available in Australia to cope with the three major colour systems and with either Beta or VHS type cassettes. Multi-standard monitors can also be provided.

The impending upsurge in home video cassettes is likely to highlight not only the different recording formats (Beta, VHS, Philips, etc) but also the major colour transmission standards — PAL, NTSC and SECAM. An overseas traveller who buys a dozen cassette features in France, Japan or America may later discover that they are of no use — the right format but the wrong system!

Video Technics in Sydney are offering a way around this problem, with multi-standard video cassette decks and multi-standard monitors.

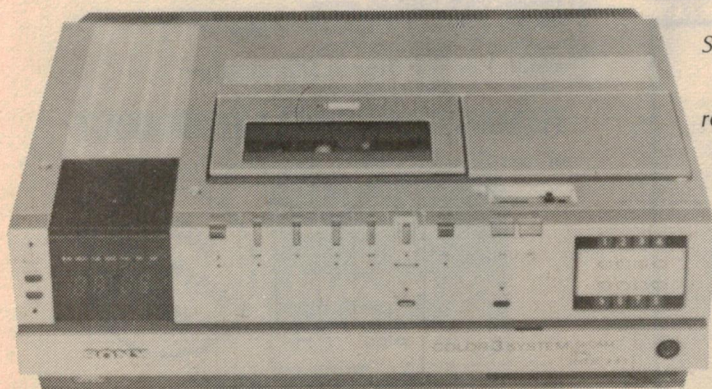
Pictured above is the National NV-8600-EM video cassette recorder, which can cope with VHS format cassettes. It can be used as a domestic video deck for local PAL standard recording and playback, with the usual facilities: VHF/UHF tuner with AFC, timer, audio dub, camera input, three-hour cassettes, etc. However, it can record in SECAM mode as well and play back in all three: PAL, SECAM, and NTSC. The deck is imported and serviced directly by Video Technics.

To cope with Beta type cassettes, the company is offering the Sony SL-T7ME deck, pictured below. Its functions parallel that of the National deck and, to judge by the manual, is primarily intended for the Middle-East market. However, it is also being sold and served, in this instance by Video Technics.

To take advantage of the three-system decks, it is necessary to mate them with a colour TV receiver/monitor which is, itself, able to operate in three modes. To meet the need, Video Technics are able to supply "General" brand receivers modified to cope with PAL, SECAM, and NTSC. The models illustrated in their literature are the GC 131 (29.5cm) and the GC 203 (48cm).

However, arrangements can be made, in some cases, to have existing receivers modified to suit and, if desired, provision added for direct video input, rather than via the tuner.

For further details: Harry Diamond, Video Technics, Carousel Centre, Shop 17, 18, 530 Oxford St, Bondi Junction, NSW 2022. Phone (02) 387 2555. Also in Brisbane.



The Sony  
SL-T7ME video  
cassette  
recorder  
recommended  
for Beta  
cassettes.

## IMAGINE.

A computer game that has drawn  
the attention of the national  
news media.

A computer game that has people  
around the world clamoring for it.

A computer game that turns your  
love life into a *menage à trois*...  
you, your mate, and your computer!

That's Interlude—the hottest new  
software program for personal  
computers.

But it's more than just a game.  
It's an experience that will tantalize  
you...romanticize you...fantasize  
you...and often surprise you.

Interlude begins with a unique  
computer interview of the partici-  
pants to determine their mood.  
Then it searches its memory to  
select the best Interlude for the  
occasion. You may be referred to  
the instruction manual which de-  
scribes most of the 106 Interludes,  
or your instructions may appear  
on your screen if you've chanced  
to hit upon one of the many sur-  
prise Interludes buried within the  
program. (When you discover  
secret Interlude #99, your love life  
may never be the same again!)

Interlude...it's fun...it's fanciful...  
it's fantastic. It's the computer game  
for adults. Are you ready for it?

## Interlude™ The Ultimate Experience.

**DICK SMITH ELECTRONICS**  
PO Box 321 North Ryde NSW 2113

☐ Yes! I want the Ultimate Experience. Please rush a copy of 'Interlude' for  
my System 80 or TRS-80 computer. I am over 18 years of age.

☐ I'm interested! But I haven't a computer. Please send details of the  
incredible System 80 computer so I can enjoy Interlude too.

Name \_\_\_\_\_

Address \_\_\_\_\_

P code \_\_\_\_\_

'Interlude' program and detailed instruction manual costs \$22.50 plus  
\$2.00 pack & post. My cheque for \$\_\_\_\_\_ is enclosed.

OR Please charge to my Bankcard. Exp. date: \_\_\_\_\_

No. 496 \_\_\_\_\_

Signature \_\_\_\_\_

(Or you can order Interlude by phone. Call Sydney (02) 888 3200 and  
ask for Bankcard Phone Orders. Quote your Bankcard number & expiry  
date, and Interlude will be sent to you the same day!)

**ALSO AVAILABLE FROM ALL DICK SMITH STORES:**  
Sydney, Melbourne, Brisbane, Adelaide, Canberra,  
Perth & Wollongong, plus re-sellers in all areas.



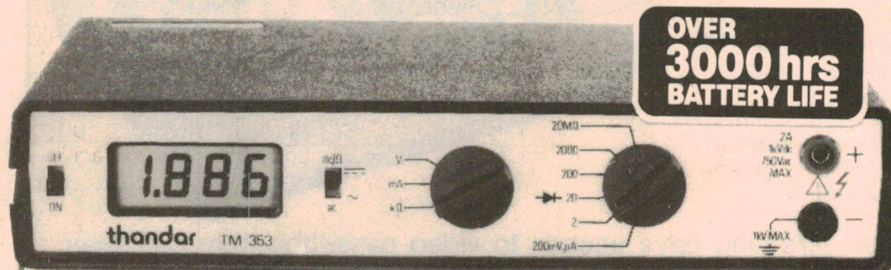
# TWO NEW THANDAR LCD MULTIMETERS

## TM351 & TM353 LCD 3½ DIGIT MULTIMETERS

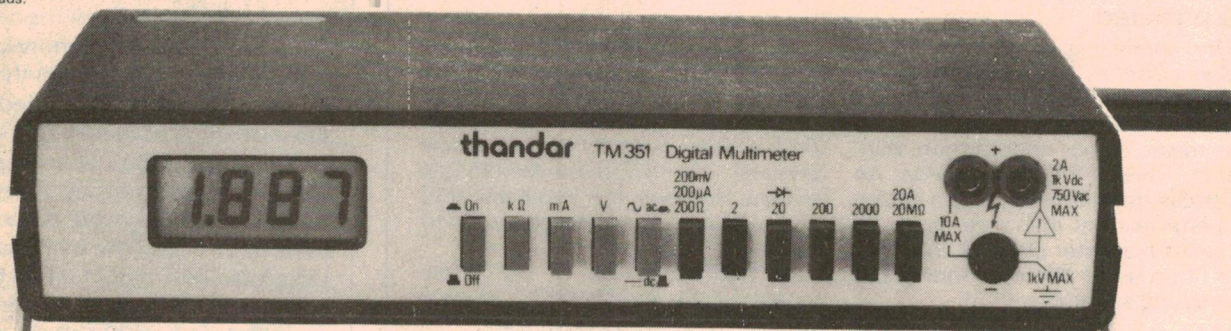
Two new laboratory quality portable multimeters using LCDs and low power LSI circuitry to give exceptionally long battery life. Both have a full measurement capability of AC and DC volts, AC and DC current, resistance and diode check, permitting measurement of voltages from 100µV to 1000V (750V AC), current from 100nA to 10A (to 2A on TM353) and resistance from 100mΩ to 20MΩ (from 1Ω on TM353). Basic accuracy on the TM351 is 0.1% and on the TM353 0.25%.

As with all Thandar products the TM351 and TM353 offer exceptional specification for money.

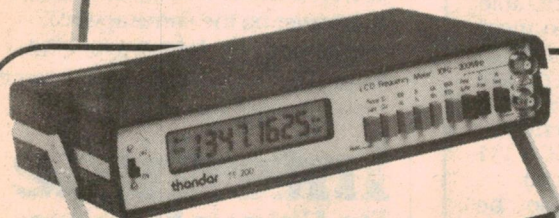
Both are supplied complete with long life alkaline batteries, and test leads.



**OVER  
3000 hrs  
BATTERY LIFE**



**UP TO  
4000 hrs  
BATTERY LIFE**



**200 hrs  
BATTERY LIFE**

### TF200 LCD FREQUENCY METER

Combines professional specification, portability and value for money.

- \*Wide frequency range — 10Hz to 200MHz (with TP600 to 600MHz)
- \*High sensitivity — 10mV rms
- \*Battery or mains operation
- \*Versatile — Lo f, Hi f, Time Av, period and totalise functions

TP600 600MHz Prescaler



### TG105 PULSE GENERATOR

- \*Wide frequency range — 5Hz to 5MHz
- \*Independent, fully variable period and pulse control
- \*Very wide duty cycle capability
- \*Auto-lockout of inadmissible control settings
- \*Additional TTL output
- \*Full gating and single-shot facilities

## OTHER PORTABLE TEST INSTRUMENTS IN THE THANDAR RANGE

SC110 Single-Trace Portable Oscilloscope

10MHz band width 10mV/div sensitivity

DM450 4½ Digit Multimeter

34 ranges; 0.05% basic accuracy

DM350 3½ Digit Multimeter

34 ranges; 0.1% basic accuracy

DM235 3½ Digit Multimeter

21 ranges; 0.5% basic accuracy

PFM200 Pocket Frequency Meter

20Hz-200MHz; 10mV sensitivity

PDM35 Pocket Digital Multimeter

16 ranges; 1% basic accuracy

## THANDAR IS A SINCLAIR PRODUCT

For full technical details together with price list please contact:

**H. ROWE  
& CO. PTY. LTD.**

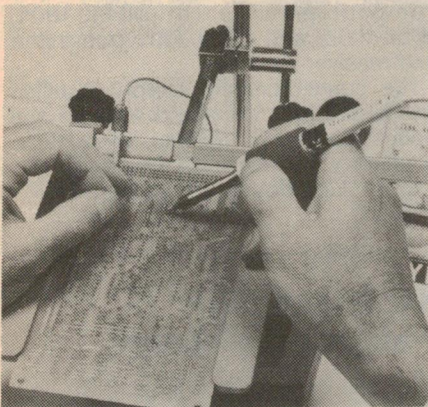
**SOLE  
AUSTRALIAN  
AGENTS**

- SYDNEY 601 6600
- MELBOURNE 329 6511 • BRISBANE 52 5231
- ADELAIDE 46 6411 • PERTH 446 6622



## New Products

### Miniature soldering tool



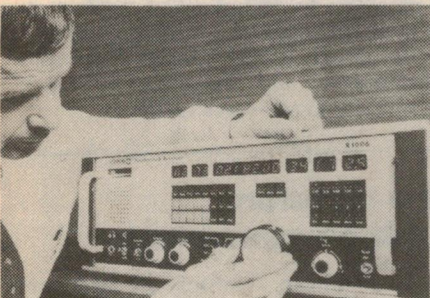
Recently released by Royston Electronics, the Model CT6 "miniature soldering pencil" maintains tip temperature within close limits. Temperature control is achieved by means of solid state sensing, electronic feedback, and zero voltage switching to avoid switching spikes which could damage circuitry.

As an extra precaution, the CT6 also includes electrostatic shields to block induced voltages from extraneous sources. Tip size is 3mm and tip temperature is infinitely variable. A more powerful tool, the Model CT7, is also available with a 5mm diameter tip.

Both tools will also operate from the Model RE800-2 soldering and desoldering station, and the RE900-2 rework station.

For further information, contact Royston Electronics, 27 Normanby Rd, Notting Hill, Vic 3168.

### Vicom is agent for Redifon



The R1006 local or remote control receiver from Redifon.

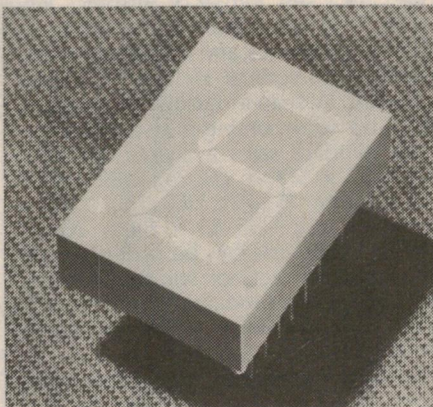
Redifon Telecommunications and Vicom International have recently signed an agency agreement which appoints Vicom International the sole Australasian Agent for the Redifon Telecommunications range of communications products.

Of particular interest in the range is the Redifon R1000 series of remote controll-

ed HF receivers. This microprocessor controlled receiver (probably one of the most advanced available in the world today) controls all functions including antenna selection, channel scanning, mode, bandwidth — the unit even supplies standard RS232 interface for direct connections to communication computers.

Further information from Vicom International, 68 Eastern Road, South Melbourne, Victoria 3205, or 339 Pacific Highway, Crows Nest, NSW 2065.

### High-efficiency 7-segment displays



Two new light-emitting diode seven segment displays, a high efficiency red (HDSP-3900) and a yellow (HDSP-4200) 20mm high, have been released by Hewlett-Packard. The displays provide a viewing range of 10 metres, and can be strobbed at peak currents of 120mA. They are designed especially for applications requiring low power consumption and large, easy to read displays, such as scales, automotive equipment and meters.

The displays are priced at \$2.78 each in quantities of 1000. For further information contact VSI Electronics (Australia) Pty Ltd, 21 Chandos Street, St Leonards, NSW 2065.

### Portable colour television camera

The recent introduction of the Hitachi FP-40S portable colour television camera completes the range of Hitachi television cameras now available in Australia from AWA Rediffusion Pty Ltd. With the inclusion of the FP-40S the range now includes five colour cameras, priced from around \$1000 to over \$10,000.

All of the cameras can be used in conjunction with video recorders from any



manufacturer, including Sony, JVC and Rank-NEC.

The FP-40S is the top of the range. It is a completely self-contained colour TV camera with three 16mm Saticon pickup tubes. The camera optical system is mounted on a diecast alloy plate, ensuring optimum mechanical stability, and a variety of automatic operating features make the camera easy to use. In fact the camera is said to offer professional users features normally expected in a camera costing twice the price.

Additional information is available from AWA Rediffusion Pty Ltd, 376 Eastern Valley Way, Roseville, NSW 2069.

### BASIC ELECTRONICS

Available from "Electronics Australia," 57 Regent St, Sydney. **PRICE \$3.50 each** OR by mail order from "Electronics Australia", PO Box 163, Beaconsfield 2014. **PRICE \$4.20 each.**



Australian  
Maritime College

**MARINE  
RADIO  
OFFICERS**

A two-year full-time course leading to a nationally accredited **ASSOCIATE DIPLOMA IN MARINE RADIOCOMMUNICATION** for those wishing to become Marine Radio Officers will be commencing at the Australian Maritime College in February, 1981.

The normal entry requirement is satisfactory completion of three subjects at HSC level, in Mathematics, a science subject and English. Equivalent qualifications and mature age applicants may be considered.

Employment prospects on successful completion of the course are good since the College offers the only courses available in Australia for Marine Radio Officers, and numbers are geared to projected demand. Further opportunities are likely to exist ashore for experienced, well qualified Radio Officers in the communications field.

Subject to demand for those who do not meet the above entry requirements, consideration may be given to offering a lower level course leading to a General Certificate the minimum statutory qualification for a Radio Officer.

For further information and application forms contact:

The Admissions Officer,  
Australian Maritime College,  
PO Box 986,  
LAUNCESTON 7250  
Tasmania  
[Tel: (003) 26 3155.]



Trading Hours: 10am-6pm Mon to Fri.

**SME  
SYSTEMS**

## are on the move again

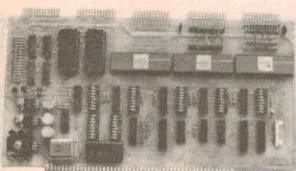
Due to an incredible increase in business, we have been forced to look for larger premises.

Consequently we will soon be moving into a new 4,500 sq. ft. air conditioned office and factory.

We are closing for the move on 24th December 1980. Re-opening on 12th January 1981 at:

22 Queen St,  
MITCHAM  
Phone: 874 3666

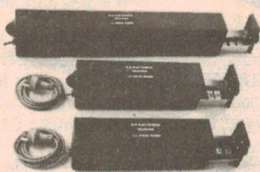
### S-100 I/O PORT BOARD



Now with  
dual serial  
ports

**DUAL SERIAL I/O CARD Features:-** dual independently controlled serial ports with TTY and RS232 outputs and inputs. Nine programmable parallel ports, crystal controlled baud rates fully buffered and address decoded. Plated through holes & solder resist mask.  
Price: Kit \$189. Ass. \$225.

### UV EPROM ERASER



New product range. Model LEE/T 15W tube, 120 min timer, up to 40 EPROMs will erase in 10/15 mins. Model MEE/T 8W tube 120 min timer, up to 10 EPROMs will erase in 20/30 mins. Model MEE is same as MEE/T but with no timer. All erasers are fully assembled and have a safety switch.  
LEE/T \$125. MEE/T \$105. MEE \$85.

**SME  
SYSTEMS**

1096 Doncaster Rd, Doncaster East, Vic 3109.  
PO Box 19, Doncaster East, 3109. Telex AA37213.  
DEALER: Canberra - 81-5011, Sydney - 661-9237.

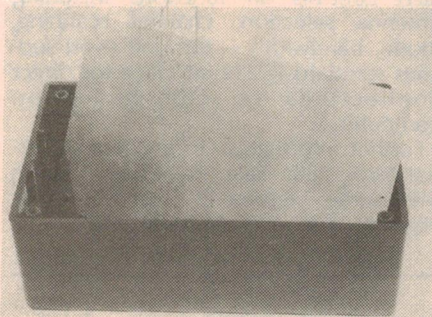
Send 66c in stamps for COMPUTER PRINTOUT CATALOGUE for more details.

ALL PRODUCTS AUSTRALIAN MADE AND EX STOCK (ALMOST).  
DEALER ENQUIRIES WELCOME.  
Prices and specs. subject to change without notice.

All prices tax free, for retail prices add 15 percent.

## New Products

### New "Jiffy Boxes" from Altronic

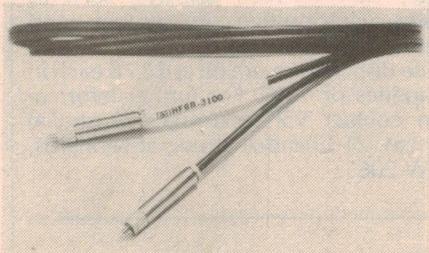


Jack O'Donnell of Altronic Distributors Pty Ltd has announced the release of "The Great New Range of Altronics Jiffy Boxes". The new boxes are available in four standard sizes and feature grooved channels for vertical slide-in PC board mounting. A snap-in facility for horizontal PC board mounting is also provided.

The standard sizes available are: UB1 150 x 90 x 50mm (\$2.75); UB2 196 x 113 x 60mm (\$3.75); UB3 130 x 68 x 41mm (\$2.25); UB5 83 x 54 x 28mm (\$1.60). PC boards can be ordered trimmed to the correct box width. For example, UB1 accommodates 87mm boards "snap-in" horizontally, or 90mm boards slid in vertically.

Altronic Distributors Pty Ltd stock a wide range of kits, components and electronic equipment for the enthusiast and the professional. Their address is 151 York St, Subiaco, Western Australia 6008. Telephone (09) 381 7233.

### Dual-channel fibre optic cables



This new fibre optic dual-channel cable and connector assembly from Hewlett-Packard, the HFBR-3100 duplex cable, offers installation convenience and durability. It can be ordered in user-specified lengths from one to 1000 metres.

The duplex optical cable consists of two single fibre cables extruded together and surrounded by a common black polyurethane jacket to form an "easy-slit zip cord". A tracer along the outside

of one of the two channels is for easy identification. The new HFBR-3100 is compatible with HP HFBR-1001, HFBR-1002, and HFBR-2001 transmitter and receiver modules.

The connectors are factory installed and tested for mechanical strength and optical quality. For further information, contact VSI Electronics (Australia) Pty Ltd, 21 Chandos St, St Leonards NSW 2065.

### Big 25mm-high 7-segment displays



Seven segment displays with a character height of 25mm are now available from Philips Electronic Components and Materials. The series 710 numeric readout is manufactured by Dialight in the United States, and features angular digits which provide error free reading over a distance of 10 metres while also being suitable for close viewing.

For easy installation the 710 series can be supplied with either solder or PCB terminals. Mounting hardware is available to allow up to 10 individual displays to be grouped together in a single unit. For further details contact Philips Electronic Components and Materials, 67 Mars Road, Lane Cove, NSW, 2066.

### Low distortion function generators

Available from Tektronix are two new instruments in its TM500 series, the FG507 and the FG501A Function Generators.

The log and linear sweep capabilities of the new Tektronix FG507 2MHz Sweep Function Generator make it suitable for a wide range of audio and telecommunications applications requiring low distortion and versatile sweep capabilities.

The second new TM500 series plug-in,



GRADUATE  
TO

# University

METERS AND  
INSTRUMENTS

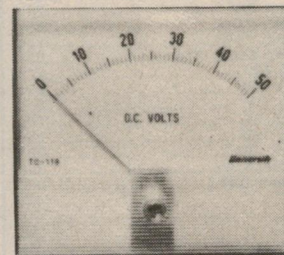
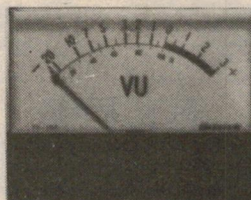
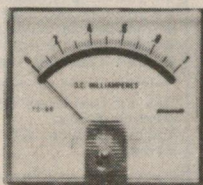
## TD SERIES PANEL METERS

Suitable for the hobbyist and manufacturer highest quality

- Complies with Australian Standard AS1042
- Moving coil • High torque • Core magnet self-shielded
- Most standard ranges available ex-stock
- Special scales, pointers & ranges on indent.

Available in 6 sizes.

Model TD-48	48 x 42mm
TD-66	66 x 60mm
TD-86	86 x 78mm
TD-106	106 x 83mm
TD-118	118 x 106mm
TD-152	152 x 110mm

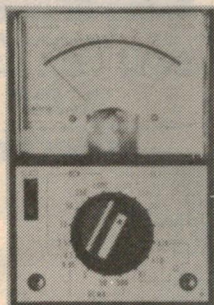


TD Series meters can be rear mounted.

- TEST INSTRUMENTS
- PANEL METERS
- DIGITAL METERS
- EDUCATIONAL EQUIPMENT
- SWITCHBOARD INSTRUMENTS

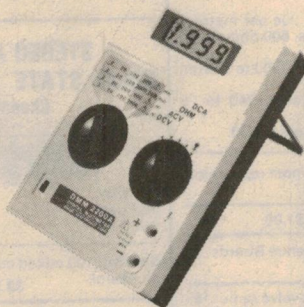
## MULTIMETERS

NEW CTI-500 "INDUSTRIAL"  
DIODE PROTECTED



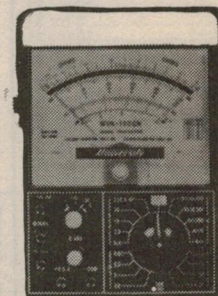
20,000Ω per V DC  
AC & DC Volts  
DC Amps to .5A  
Resistance & dB  
Size: 130 x 90 x 38mm  
an excellent general purpose unit

DIGITAL MODEL 2200A  
3½ DIGIT LCD DISPLAY, 12MM HIGH



200 hours continuous operation  
Auto zero and Auto polarity  
Low battery warning  
Two input terminals  
Over range indication  
Overload protection

THE FAMOUS MVA-100CN "DELUXE"  
NOW WITH FUSE & DIODE PROTECTION



100,000Ω per V DC  
AC & DC Volts to 1kV  
AC & DC Amps to 10A  
Resistance .1Ω to 200MΩ  
dB -20 to +62dB  
4mm Terminals  
Polarity Switch  
Shock proof movement  
Size: 180 x 140 x 80mm

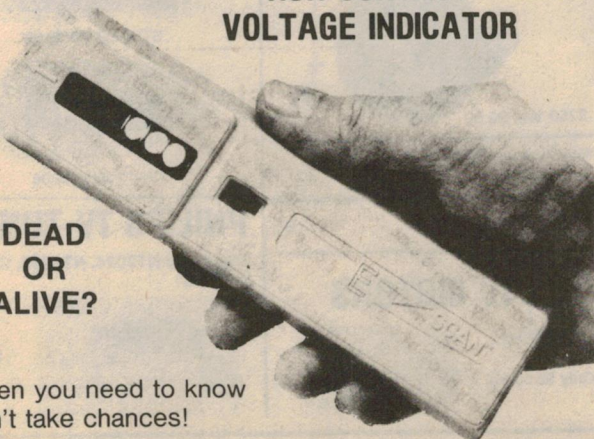
## TEST INSTRUMENTS

## EZ SCAN

NON CONTACT  
VOLTAGE INDICATOR

DEAD  
OR  
ALIVE?

When you need to know  
don't take chances!



The non contact EZ-Scan unit gives an immediate visual indication of voltage with or without current flowing at distances up to 15cm from the source. Battery powered and all solid state, the unit is small enough to be carried in a pocket, and tough enough to leave in a tool box.

To find a break in a cable, a bad earth, a faulty fitting or just to know if it's live — use the EZ-Scan for all unshielded AC electrical systems, 60V and higher.

PRICE: HIGHEST QUALITY at the LOWEST PRICE  
GUARANTEE: 90-day, backed by University after sales service  
SERVICE: 24-hour efficient repair service

UNIVERSITY GRAHAM  
INSTRUMENTS PTY LTD

PO BOX 204, ENFIELD, NSW 2136  
PHONE (02) 53 0644; TELEX AA21398  
MELBOURNE PHONE (03) 387 6170



## RESISTORS

150 ohm, 5W	20c
10 ohm, 5W	20c
47 ohm, 5W	20c
12 ohm, 3W	20c
2.5 ohm, 3W	20c
33 ohm, 3W	20c
8 ohm, 10W	25c
4000 ohm, 10W	25c
100 ohm, 5W	20c
330 ohm, 10W	25c
220 ohm, 5W	20c
5 ohm, 5W	20c
220 ohm, 10W	25c
950 ohm, 3W	20c
115 ohm, 5W	20c
10 ohm, 5W	20c
1k ohm, 5W	20c
5000 ohm, 5W	20c
6.8k ohm, 3W	20c
3300 ohm, 10W	25c
6800 ohm, 10W	25c
1500 ohm DUAL, 21W	50c
50 ohm, 5W	20c
330 ohm, 5W	20c
1k ohm, 5W	20c
820 ohm, 5W	20c
12 ohm, 10W	25c
470 ohm, 7W	20c
4700 ohm, 4.5W	20c
5000 ohm, 10W	25c
8.2 ohm	5W
3.3k	7W
1 ohm	5W
10k	7W
2.5 ohm	3W

## CAPACITORS

0.0039uF, 1500V	20c ea.
6N8, 1500V	20c ea.
0.0068uF, 1500V	20c ea.
1200PF, 400V	10 for \$1
0.068uF, 400V	5 for \$1
2200PF, 630V	10 for \$1
0.47uF, 250V	10 for \$1
0.10uF, 400V	5 for \$1
0.082uF, 160V	10 for \$1
26k, 250V	10 for \$1
0.041uF, 400V	10 for \$1
0.033uF, 250V	5 for \$1
0.027uF, 100V	20 for \$1
220uF, 10V	10 for \$1
1uF, 350V	10 for \$1
470uF, 40V	5 for \$1
1000uF, 16V	10 for \$1
2.2uF, 200V	10 for \$1
0.047uF, 1500V	50c
47uF, 25V	4 for \$1
680uF, 40V	50c
22k, 100V	20c
330uF, 25V	25c
2.2uF, 200V	30c
470uF, 40V	30c
680uF, 35V	50c
0.015uF, 250V	25c
2500uF, 35V	\$1
1uF, 100V	25c
1000uF, 16V	50c
220uF, 16V	50c
2000uF, 63V	\$1
0.47uF, 400V	50c
680k, 250V	25c
012, 250V	25c
15NF, 250	10c
120k, 250V	20
10uF, 315V	25c
0.056, 250V	10c

### Slide Pots

250K-50K	3 for \$1
Dual 500K	3 for \$1
1 Meg	3 for \$1
2 Meg	3 for \$1
Including Fancy Gold Knobs	
25K dual	2 for \$1

### SPECIAL

100 mixed resistors, all useful	\$2.
100 mixed capacitors, fresh stock	\$2.

### AUDIO LEADS

3.5m to 3.5m, 7ft	75c
3.5m to 6.5m, 7ft	75c
6.5, 7ft	50c

### MICRO SWITCH

5A, 250V AC	75c ea.
-------------	---------

### TUNING CAPS

2 and 3 gang	\$1 ea.
Min 2 gang	50c

### FUSES

0.5A, 2A, 3.25	10 for \$1
In line fuse holders	30c
RCA jack plugs and sockets	40c pair

# L.E. CHAPMAN

122 PITT ROAD, NTH CURL CURL.  
MAIL ORDERS: BOX 156, DEE WHY, NSW. 2099.  
TELEPHONE 93-1848.

## SPECIAL TRANSISTORS

AD161-162	\$2.50 pr
BSC 901A	\$1.50 ea.
BC 548	10 for \$1
AD 149	\$3 pr

## ELECTROS

470uF, 25V	5 for \$1
400uF, 10V	5 for \$1
47uF, 63V	5 for \$1
350uF, 16V	2 for \$1
27uF, 160V	5 for \$1
25uF, 63V	10 for \$1
22uF, 160V	10 for \$1
47uF, 16V	5 for \$1
47uF, 200V	5 for \$1
220uF, 10V	10 for \$1
68uF, 16V	10 for \$1
2500uF, 63V	2 for \$1

- Telescopic aerials, \$1.50
- Top quality, low impedance microphones, \$3.50
- 6 inch ferrite rods, 75c
- Rainbow lead, 5 strand, 20c per metre
- Line output transformers, 600 ohm, to 15 ohm, 20 watts, \$5
- Line output transformers, 1200 to 3/ohm, 5 watt, \$1
- Power supply units, filtered, 240 to 20 volt, \$12
- 240 to 15 volt transformers, \$3.50.

Power leads 240 volt, suit most tape recorders, radios, etc. \$1 each.

TV Stick Rectifiers 20SC, \$1.00.

Philips Colour TV Convergence Boards, \$3 each.

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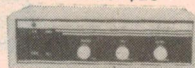
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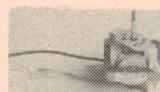
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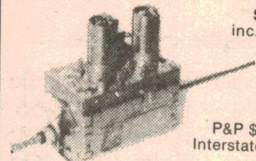


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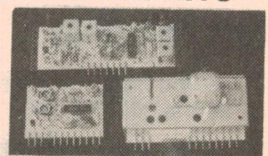
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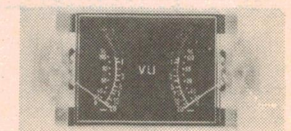
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## New Products

the FG501A 2MHz Function Generator, is designed for users who require the same low distortion sine waves but do not need the sweep capabilities. The FG501A replaces the FG501 Function Generator, providing increased frequency range, variable symmetry and a triggered mode of operation.

Both Function Generators provide low-distortion outputs from 0.002Hz to 2MHz, and are capable of generating five basic waveforms — sine, square, triangular, ramp and pulse — at output levels up to 30V peak-to-peak from a 50 ohm source. A step attenuator provides 60dB of output signal attenuation in 20dB steps, with an additional 20dB of variable attenuation.

Further information on the two new instruments can be obtained from Tektronix Australia Pty Ltd, 80 Waterloo Road, North Ryde, NSW 2113.

## Automatic testing for PCB assemblies



Elmeasco Instruments has established what is believed to be the first automated PCB testing and programming facility of its kind in Australia. The new facility is equipped with a top of the line Fluke 3040A digital and analog board tester. Up to 232 digital I/O pins and up to eight analog pins can be checked with automatic fault emulation providing close to 100% fault coverage.

The new facility, based at Mortlake NSW, has already been awarded a major defence contract.

Further information is available from Elmeasco Programming Services, PO Box 30, Concord 2137.

## Rack mounting power line filter

Belling & Lee has announced a new L2140 rack mounting power line filter. The filter is available in 2A and 6A versions, and is primarily intended for installation in microcomputers, machine tool control systems and similar



equipment to protect them against mains borne interference and to ensure compliance with BS800 and IEC/VDE specifications covering mains interference from equipment.

The assembly complies with the safety requirements of UL and other European approval authorities, and additional security is provided by the use of self healing metalised paper capacitors and epoxy resin encapsulation.

For complete information on the Belling & Lee Rack Mounting Filter contact Tecnico Electronics, PO Box 50, Lane Cove, NSW, 2066, or PO Box 520, Clayton, Vic 3168.

## Scope-Panavise PC board holder



Scope Laboratories now has available the Scope-Panavise printed circuit board holder. The unit can be supplied in various configurations, making it suitable for a wide range of applications. For instance, five mounting arrangements are possible: a tray base with recesses for components, a G clamp, suction, screws, or a heavy cast iron pedestal.

The mounting head can be rotated and tilted to position the PCB conveniently, and five alternative head styles can be supplied, including a slotted, adjustable board holder, hard or soft jawed engineers vices, a neoprene jawed 152mm vice and face plates.

More information is available from Scope Laboratories, Box 63, Niddrie, Vic 3042.

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## Books & Literature

### Programming the Z80 Microcomputer

**PROGRAMMING THE Z80**, by Rodnay Zaks. Second Edition. Soft covers, 624 pages, 217mm x 140mm, illustrated with diagrams and flowcharts. Published by Sybex Inc, 1980. Price \$14.95.

The Z80 is one of the most popular eight-bit microprocessors available, and not without reason. It's "upward compatibility" with the 8080, combined with a large number of additions and enhancements to the original 8080 instruction set make it a very powerful machine.

The size and the complexity of the set of instructions executed by the Z80 has one disadvantage however; it is hard to come to grips with. For the person just approaching programming, it is hard even to know where to start!

Many books and articles have been written in an attempt to overcome this problem, but this one by Rodnay Zaks is one of the best we have seen. The book is written as an educational text and a self-contained reference guide, and as such will be of use to both the experienced programmer and the beginner. In 11 chapters the book guides the reader from basic concepts to data structures and program development techniques, covering along the way Z80 hardware organisation, addressing techniques, input and output routines and devices, assembly language programming techniques and applications examples.

The text is clearly written and comprehensive, and it is well supported by extensive illustrations, flowcharts and diagrams. Seven appendices provide further information and convenient references to hexadecimal and ASCII conversion, a table of displacements for relative addressing, decimal to BCD conversion, a short form guide to the Z80 instruction codes (which are covered in depth in the body of the text) and charts of Z80 and 8080 equivalent instruction codes.

Particularly worthy of mention is the first chapter, Basic Concepts, which provides an introduction to assembly language programming flowcharts and data representation within a microprocessor. It is almost essential reading for anyone involved with microprocessors.

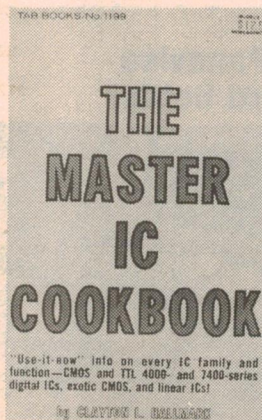
Throughout the book exercises and

questions are left for the reader to solve. These exercises are carefully graded in difficulty, and their successful completion is a welcome confirmation of the reader's grasp of the material presented.

Microprocessor programming is not something that can be learnt from a book, and the author constantly stresses the need for practice with an actual system. Explanatory texts and reference guides can be of great assistance to the programmer however, and anyone working with the Z80 will find this latest book an excellent coverage of assembly language programming.

Our review copy came from Dick Smith Electronics, and copies should be available from DSE branches in all states. (PV).

### IC Cookbook



**THE MASTER IC COOKBOOK**, by Clayton L. Hallmark. Published by TAB Books March 1980, USA. Soft covers, 130mm x 209mm, 476 pages. Illustrated with pin-out diagrams and circuits. Price \$12.50.

The first point we should make is that "The Master IC Cookbook" is actually an IC data book and does not present any application circuits for the ICs. This is quite reasonable though considering the large scope of the book, which covers all the standard 4000 and 74C series CMOS, TTL and other more exotic IC types.

Four sections are included in the book, viz CMOS, Exotic CMOS, Linear and TTL plus a brief introduction to the characteristics of the various logic

families. Data provided in the various sections is brief and to the point. Typically one page is devoted to each device and includes a function description and a pin-out diagram. Actual electrical characteristics such as propagation delays and input and output characteristics are not included, unfortunately. (RdJ).

### Electronic Basics

**ELEMENTS OF ELECTRONICS**, Book 3, by F. A. Wilson. Published by Bernard Babani Ltd, London. Stiff paper covers, 204 pages 180mm x 118mm, illustrated by diagrams and circuits. Price in Australia \$6.75.

Books 1 and 2 in this series were reviewed in January last and summarised as being well written and planned, and presumably intended for use in study courses. They covered basic theory and basic AC circuit theory respectively, and this present volume was foreshadowed.

As with the previous texts, this new one deliberately invokes mathematical and graphical expressions to supplement the explanatory prose, again confirming its student orientation.

The first section to page 27, "The physics of semiconductors", is completely descriptive in character. It starts with the atomic structure, adds the concept of conduction, then the P-N junctions, and looks at the behaviour of semiconductor materials, diodes and transistors.

Section 2 takes a detailed look at "Semiconductor Characteristics", while section 3 — about 100 pages in length — looks at semiconductors in typical circuit configurations: rectifiers, amplifiers, oscillators and switching mode.

A fourth section surveys microminiature technology and this is followed by appendices covering abbreviations, circuit symbols, binary and number systems, and mathematics.

All told, it appeals as a compact and useful book, and good value in terms of today's prices. Our copy came from the Technical Book & Magazine Co Pty Ltd, 289-299 Swanston St, Melbourne, 3000. (W.N.W.)

### TRS-80 Interfacing

**TRS-80 INTERFACING BOOK 1** by Jonathan A. Titus. Soft covers, 190 pages, 216mm x 134mm, illustrated with photographs and diagrams. Published by Howard W. Sams & Co, Inc. Price \$11.95.

This book will be useful to TRS-80 owners or anyone with Z80 based systems who would like to use their computer for monitoring or controlling external devices. Although specifically



dealing with the TRS-80 and Level II Basic, none of the principles or experiments described are exclusive to that machine.

The purpose of this book, as stated in the preface, is to introduce the reader to the signals available within the TRS-80 computer and to show how they can be used to control external devices with Basic programs. A breadboard design procedure is used, and the text is supported by numerous practical experiments and circuits.

The book commences with a discussion of the control signals available within the TRS-80 (which are the signals generated by the Z80 processor, with the exception that IORQ signal is externally gated with the RD and WR signals to create IN and OUT signals on the TRS-80 expansion interface connector). The Input and Output statements of Level II Basic are then discussed in detail, together with the PEEK and POKE statements used for accessing memory and memory-mapped I/O devices.

Chapter two covers interfacing to the TRS-80, discussing I/O address decoding and device selection. Chapter three moves on to the use of actual devices, and provides details of parallel input and output ports, three-state logic, and a discussion of memory mapped I/O. Chapter four concerns flags, the means by which external devices inform the computer that they either have data to transmit or require data from the computer. The logical operations available in Basic are discussed, as a means of testing the status of these flag bits, and many useful examples are provided.

Chapter five describes the author's approach to breadboarding circuits for TRS-80 interfacing. The chapter gives complete circuit diagrams and constructional details of a self-contained breadboard circuit with its own power supply, logic probe and address decoding. Appendix D of the book is a parts list for the construction of the interface board, while Appendix E provides the artwork for a double-sided printed circuit board.

The final chapter of the book, Chapter six, brings all the information together. This chapter occupies the last half of the book, and is a guide to the use of the experimental breadboard set-up for interfacing various circuits to the TRS-80, using readily available 7400 series devices. Eighteen experiments are described and illustrated, ranging from setting and resetting a single output bit to the interfacing of an analog-to-digital converter.

There are five appendices to the book. D and E have been mentioned, and in addition there are details of the lamp monitors, logic switches and pulse circuits used in the experiments, a list of parts for the experiments and a copy of the Mostek technical data for the Z80 microprocessor.

All together this book can be recommended. Our review copy came from McGill's Authorised Newsagency Pty Ltd, 187 Elizabeth St, Melbourne, 3000. (PV).

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## Rochberg/Stern violin concerto: "a strange work"

**ROCHBERG** — Violin Concerto Isaac Stern (violin) and the Pittsburgh Orchestra conducted by Andre Previn. CBS Stereo disc CB 331.

This apparition has haunted me since it arrived unexpectedly from CBS some weeks ago. The first paragraph of the accompanying "explanatory" sheet reads, I quote: "The dedication of the violin in concerto by Rochberg reads 'Commissioned by the Pittsburgh Symphony, William Steinberg musical director, in memory of Donald Steinfurst for Isaac Stern with the assistance of grants from the National Endowments for the Arts and the Pittsburgh Post Gazette.'" Just who Donald Steinfurst was I have no idea. It is also the first time I have heard Rochberg's name mentioned. Steinberg having gone to his reward the present recording is conducted by Andre Previn.

The "explanatory" sheet goes on — among many other things — to say that Rochberg apparently lost his tonal viginity when he met Luigi Dallapiccola in Rome around 1950. During the process he interested himself in "duration as pro-

cess" and "projection of densities" whatever they might mean. But, by many passages in the concerto, he is apparently repenting his atonal and serial indiscretions and now and again returns to straight out romanticism.

Another reason for this is that he probably thought he'd better give Stern something for his money for Rochberg was paid for something Stern could use, however rarely, on the concert platform. The work is strangely constructed in five movements, the two outer ones ac-

ting chiefly as introduction and epilogue. Delete these and the remaining three movements could make a concerto, if not a very exciting one. At any rate the two outer movements consist of harsh atonalities but the second, marked Intermezzo is completely tonal. There is no mistaking the third movement as anything but an "In Memoriam", I expect to the mysterious Mr Steinfurst. It has some melodies, never distinguished, but it is no surprise to hear Stern play them

admirably.

The whole work sounds as if you have heard parts of it before though not necessarily at the same time. In any case, Rochberg has written plenty of showy stuff for both the soloist and orchestra. He is an expert orchestrator and has given Stern and Previn plenty with which to display their virtuosity. Though just how often they will be called upon to do so in this strange work is to me an unanswerable question. (J.R.)



## Bach/Glen Gould "Eccentric, often brilliant"

**J. S. BACH** — Three Toccatas — In D Major BWV192, in F Sharp Minor BWV 910, and D Minor BWV 913. Glenn Gould (piano). CBS Stereo Records Import CB331.

The eccentric but often brilliant Glenn Gould has reappeared on the dealers' shelves with a recording of Bach Toccatas made back in 1936 but only just released. From what I can learn, he has recorded nothing since. The reason — he cannot find a studio to suit his unusual acoustic demands!

For a while he found something to please him better than the New York Studio of CBS in a hall at the top of a department store in Toronto. Here there was only room for a chamber orchestra but Gould found that, by putting the piano below the stage, not on the stage, he could record the sound he wanted. He has long sought a compromise between the timbre of a harpsichord, described by the late great Beecham as "like a bird cage played with a toasting fork", and that of a modern concert grand.

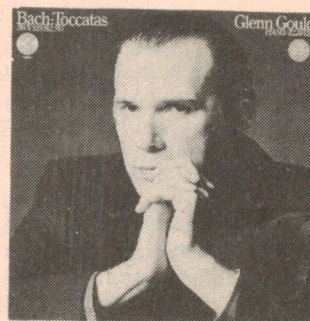
On the piano, he uses a beautifully clean harpsichord technique of detached notes and some ingenious if unorthodox phrasing. But everything is still quite unlike the sound in Bach's day. Gould's sound is like a robust ghost of the baroque but you are still listening to a

modern piano, even one with special features.

Busoni in his one-time famous Bach transcriptions, went all out for a full Bluthner grand tone, without any attempt to imitate a harpsichord. Gould has fallen between the two styles without benefiting either. By the way, the Toronto store closed in 1977 but there is talk of it reopening soon so Gould may, repeat may, return there to record again. If he should, he has stated that he will re-record the works on the disc under review "to lift phrases into a different context to perhaps present a greater sense of contrast". (The quote is Gould's.)

He also stated that some of Bach's counterpoint was not "up to scratch in some pretty bad fugue writing". To quote Beecham again, he once described it as "protestant counterpoint".

Gould can still be heard singing faintly now and again while he is playing but his voice is so faint that I never found it disturbing. The three works are uneven in quality and not very interesting after one hearing, and the disc is more of a curiosity than one to cherish. (J.R.)



Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).





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## RECORDS & TAPES — continued

**BEETHOVEN — Symphonies Nos. 1 in C Major and No. 2 in D Major with Lorin Maazel and the Cleveland Orchestra. CBS Masterworks Stereo Disc SBR236003.**

The spirit of George Szell still sometimes manifests itself nowadays in performances of the Cleveland Orchestra, despite the different temperaments of the late conductor and the orchestra's present incumbent. George Szell, acting with all the merciless zeal of a Regimental Sergeant Major, brought the Cleveland to a state of precision unmatched by any competitor. This impressive discipline has been commendably preserved by Maazel.

Szell's interpretations were always unreservedly classical, sometimes even a little chilly. But his perfection of line and dynamics were always unswervingly correct, the proportions superbly judged. In fact the whole was ultra-Apollonian—if you will allow me such a barbaric mixture of Latin and Greek as a lazy way of describing Nietzscheanism. Maazel, on the other hand is a good deal warmer — to put it bluntly more human — although there are still times when you can sense old Szell now and again looking over his shoulder.

These two symphonies as played by Maazel seem to me to confirm this whimsy of mine and I state this without any intention of ever so slightly denigrating Maazel. Maazel wears the mantle of his predecessor as well as anyone I can imagine and to this great merit must be added the benefit of the improved sound awarded him by the last few years of better engineering. (J.R.)

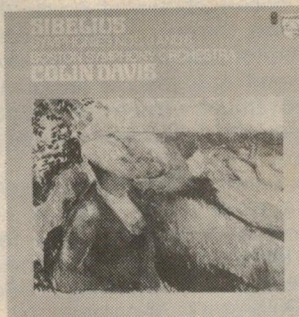
☆ ☆ ☆

**SIBELIUS: Symphonies No. 3 in C major, op 52 & No. 6 in D minor, op 104. Boston Symphony Orchestra, conducted by Colin Davis. World Record Club (Philips) stereo disc R 06061.**

**SIBELIUS: Symphonies No. 5 in E flat, op 82 & No. 7 in C major, op 105. Boston Symphony Orchestra, conducted by Colin Davis. World Record Club (Philips) stereo disc R 06087.**

Sibelius never has been one of the most widely-popular composers, but he has been exceptionally well served by the gramophone record. There has been a string of fine conductors recording Sibelius' symphonies, starting with Beecham, Anthony Collins, Barbiroli and Hannikainen, with interesting contributions from Karajan, Sargent, Bernstein and Abravanel, to say nothing of all the Scandinavians, who feel most at home with this music.

Colin Davis, who won his spurs with Beecham's RPO and proceeded to enliven various British orchestras, has been "principal guest conductor" at



Boston since 1973 and he enters the Sibelius stakes with utter confidence. He is, throughout, a conductor who knows exactly what he wants, who knows what his players can give and makes sure they do give it. His tempi and phrasing, throughout these four works, are exemplary; there may be, in places, a hint of too much deliberation — the kind of tempo that would probably seem impossibly slow to Bernstein or Karajan — but this never reaches a point where the music's dramatic impact might suffer.

Judging by the current catalogue, the 3rd is the least popular of these symphonies, with only one recorded version; the sixth and seventh show up twice each, the fifth seven times! I rather like the geniality of the 3rd, with its echoes of Dvorak and even Mahler; it is full of lovely tunes and makes glorious use of the strings; the Andantino is a charmed, constantly moving idyll, without any brass. The 6th, coupled with it, suits this role well, with its pleasantly

## SAINT-SAENS SYMPHONY

"dynamic range is enormous"

**SAINT-SAENS. Symphony No. 3 "Organ". Eugene Ormandy, the Philadelphia Orchestra, with Michael Murray, Organist. Telarc digital master stereo 10051. [From PC Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612]**

I was most interested to hear this new Telarc recording, prompted by an enthusiastic early review from overseas. It was made in February, this year, in the huge St Francis de Sales Church in Philadelphia, with its magnificent Harrison/Cavaille-Coll organ. The instrument had to be re-pitched for the occasion, seating removed to accommodate the orchestra and traffic diverted from adjacent streets.

If you buy the album you will find, inside the excellent jacket, a wealth of other information on the composer, the organ and church, the conductor and the organist. This, plus the usual run-down on Telarc's digital mastering process.

But, technically, the disc did not live up to all my expectations. The very quiet opening passage is heard against a low

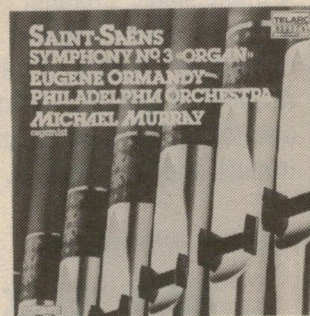
pastoral opening — this is rather "private" music, free of anything demonstrably public. Although the 7th is also little known, it better fits the frame of what we tend to expect in a Sibelius work — at any rate, no-one is likely to remain unmoved by the mysterious stirrings in the haunted adagio. These are excellent recordings of fine performances! (P.F.)

☆ ☆ ☆

**DVORAK — Symphony No. 9 in E Minor (From The New World). Concertgebouw Orchestra, Amsterdam, conducted by Sir Colin Davis. Philips Stereo Original reissued here by the World Record Club for its members. 9500 511.**

My thanks to Sir Colin Davis for turning an anticipated bore — What! another New World — into a refreshing experience. Davis observes all Dvorak's markings scrupulously but doesn't try to pretty the work up. Under this treatment, the symphony loses none of its excitement; indeed, in my opinion, it gains vastly.

The only other recording I can recall like Davis' immaculate performance is an old 78 George Szell made with the Czech Philharmonic back in the late 1930s. And Davis' account has all the advantages of very fine modern engineering. Davis' method is to set a tempo and stick to it, no matter how enticing it might be to change it slightly here and there. Yet Davis skilfully avoids any hint of pedantry; the warm passages glow and the climaxes are brought off brilliantly without bombast.



frequency rumble that probably had to do with the building and its environs. The string tone is no better than "normal" but, against this, the organ sound is impressive, even startling at times.

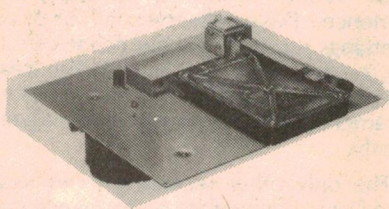
In fact, the dynamic range is enormous and the finale, with organ and orchestra at full stretch, must be among the most complex high-level musical sounds I've ever encountered off disc. Indeed, if you set the opening bars at more than a whisper, don't be surprised if the bargraph meters each nudge the 100W mark on peaks. I doubt that anything but digital could cope with it.

It's a pity about the other end of the range. My tip is that, for this kind of performance, the limitation proved to be in the acoustics and the noise ambience of the building itself. (W.N.W.)



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## RECORDS & TAPES — continued

The Concertgebouw of Amsterdam is in fine form, the only player to seem not quite comfortable in Davis' sternly controlled reading is the cor anglais in the slow movement. Otherwise the playing is faultless with a wonderful bloom on its opulence.

This mention of the Concertgebouw seems a good place to thank Mr G. Ligertmost of Shoalwater, WA for his friendly letter picking me up on the lapse of concentration in reviewing the Rotterdam Orchestra's recording of two Rachmaninov symphonies recently. I carelessly wrote "Gewandhaus" instead of "Concertgebouw". The former, of course, is a famous concert hall in Leipzig, East Germany, while the Concertgebouw is an Amsterdam institution. Mr Ligertmost also adds, I quote: "I sat in at the birth (of the Rotterdam Philharmonic) in the 30s when Eduard Flipse started up in Rotterdam with 'new music' to beat the stranglehold of the Amsterdam boffins and their famous orchestra under Mengelberg". (J.R.)

☆ ☆ ☆  
**BRIAN: Symphonies Nos. 8 and 9. Royal Liverpool Philharmonic Orchestra; conducted by Sir Charles Groves. World Record (HMV) quadraphonic disc QR 06089.**

Since Havergal Brian's death in 1972 at the age of 96, the obscurity in which he lived and composed has begun to lift and more of his works are gradually emerging; even so, it does not seem likely that many of us will ever hear all 32 of his symphonies — the last 21 of them created after he had passed the age of 80! I've heard a mere half-dozen of them and can only assert that each work is highly original, quite substantial and well

worth closer study.

The 8th symphony was written in 1949 and is lavishly scored, including very considerably percussion, harp, piano and organ. In a single movement of conflicting moods and horrifying complexity, Brian seems to be fighting all the way and the work remains, thematically at least, unresolved. The 9th, written in 1951 (after an operatic score for "Turandot"), is not quite as problematical. Again, there are no breaks, but the work consists of three movements in the classical pattern. This symphony, which Groves has repeatedly performed in concert, may be one of Brian's works to enter the regular repertory. Both symphonies are undoubtedly great music, with tremendous range of textures and dynamics, splendidly performed and recorded. It might be noted that this is the very kind of music best suited to quadraphony. (P.F.)

☆ ☆ ☆

**22 OF THE GREATEST WALTZES. Lawrence Welk. Stereo, Two-record set. Interfusion L-45757/8. Festival release.**

Couple the name of Lawrence Welk and 22 evergreen waltzes and you'll know what to expect from this double-fold album. It's ready made for nostalgia, whether you turn the volume up, or turn it down to a dreamy background.

Here are just a few of the titles: Blue Danube — Silver Moon — Skaters Waltz — Memories — Paradise — Danube Waves — Dolores — Merry Widow — Vienna Woods — Over the Waves ... and so on. You'll know them all.

It's all orchestral, of course. I was not too impressed with the sound quality of

## CHOPIN SONATA . . .

clean sound, excellent dynamics

**STEVEN GORDON PLAYS CHOPIN: The Sonata in B Minor, op. 58. Stereo, 45rpm, Reference Recordings, Classic Series RR-5. [From MR Acoustics, PO Box 165 Annerley, Qld 4103. Phone (07) 48 7598]**

This recording comes in a handsome double-fold jacket carrying lengthy biographical notes on the composer and climaxing with this particular sonata, Chopin's last but one major composition. There is comment on the work itself, to which I need add only one remark: if you do not know the work, there is no need for hesitation; it is very listenable, as presented here by Steven Gordon, a very capable exponent of Chopin's music.

The recording itself is one of the "Reference" series, involving "purist" care with acoustics, microphones, signal

circuits, etc, and ending up in a specially modified master tape recorder. After transfer to disc at half speed by JVC, actual production is handled by Teldec in Germany.

With all this care, it is not surprising that the quality is good, with clean sound and excellent dynamics. How good, how clean? Well, ranking with the best from an analog master but just marginally lacking in the unstressed clarity of a comparable recording from a digital source. But, against this, it's six or seven dollars cheaper! (W.N.W.)





# Christmas & devotional

**THE WORD FAMILY CHRISTMAS ALBUM.** Stereo, Word WSB-8842. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135).

With Christmas in the offing, you're possibly thinking about another Christmas album. But what? Jingle bells, carols or multi-cultural.

This new Word album might be the solution to your dilemma, with songs by a number of well known Word artists: Bill Gaither Trio—Medley and "He's Still The King Of Kings"; Tom Netherton — "Why Isn't Everybody Singing Allelu!"; Evie — "Away In A Manger" and "O Holy Night"; Dave Boyer — "Carol Of Christmas"; B. J. Thomas — "Silent Night"; Mike Douglas — "Do You Hear What I Hear?" Robert Hale & Dean Wilder — "O Come All Ye Faithful"; Anita Bryant — "What Child Is This?".

They're all top-line artists, with good arrangements and good accompaniment. Quality is fine and, all told, it would add up to an excellent addition to your devotional library, both for Yuletide and general listening. (W.N.W.)

☆ ☆ ☆

**FOR THE BEST. B. J. Thomas. Stereo, MCA-3231. (Released through Astor).**

In July, I reviewed another album from B. J. Thomas on the Myrrh label, from

the opening track but, fortunately, what follows is better, with record two in particular being quite bright and clean.

One other thing I should mention: There are 22 tracks, for sure, but they are relatively short and the total playing time adds up to about 50 minutes only for the two discs. If you're expecting a prolonged program, you'll be disappointed; if you want a happy reminder of other days, you'll like it! (W.N.W.)

☆ ☆ ☆

**AIN'T WE GOT FUN. The Mighty Marengi Fairground Organ. Stereo, World Record Club WRC R-06369.**

If you are inclined to regard the theatre Wurlitzers and Christys as historic, I wonder how you would react to one of their predecessors — a turn of the century fairground organ. The property of Lord Montagu of Beaulieu, it features at his National Motor Museum, where it is teamed with an equally venerable steam traction engine. And, believe it or not the old engine carries a 33kW 110V AC generator, sufficient to power the organ, plus other fairground machinery.

In modern jargon, the old organ has a non-volatile memory bank of tunes, in the form of a book of folding punched cards. There are 20 tunes in all, some

Word Records Australia. Here, he is featured on MCA/Songbird, a new Christian label, handled in Australia by Astor.

Now a committed Christian, B.J.T. professes himself free to sing anything that has a positive theme, but all the titles on this release are modern devotional. They will be new to most but the lyrics are printed in full on an inside sheet.

The opening tracks are rock format but just when you might assume that all 10 numbers will be the same, a progressive change becomes evident. B.J.T.'s style will not appeal to everyone but he certainly has something to say to the rising generations:

Walkin' On A Cloud — Everything Always Works Out For The Best — The Faith That Comes From You — Everyday Man — Nothin' Could Be Better — Jesus-Hearted People — Nashville — More Of You — No Limit — You.

As I remarked about the earlier album: if the music appeals, you have no need to worry about the technical quality; it's fine. (W.N.W.)

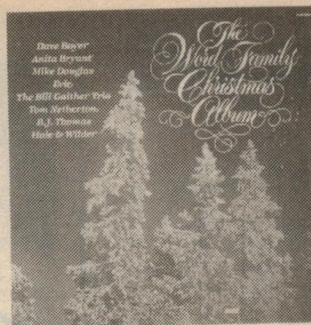
☆ ☆ ☆

**FOCUS ON RAY CHARLES. Two Record Set. Stereo. World Record Club R 05303.**

The jacket notes describe Ray Charles as a legend in his own lifetime — and few would argue with that tribute. A master of the Rhythm and Blues field, he has a unique genius that has captured audiences all over the world.

This two-record set from the World Record Club is a credit to the man, his music and to his courage. I need say no more than list the track titles: Take These Chains From My Heart — Your Cheatin' Heart — Baby, It's Cold Outside — Don't Set Me Free — I Can't Stop Loving You — Unchain My Heart — Cryin' Time — Ol' Man River — Hit The Road Jack — Cry Me A River — Georgia On My Mind.

In summary, an album that Ray Charles fans should not miss. (G.S.)



**WORLD FAMOUS**

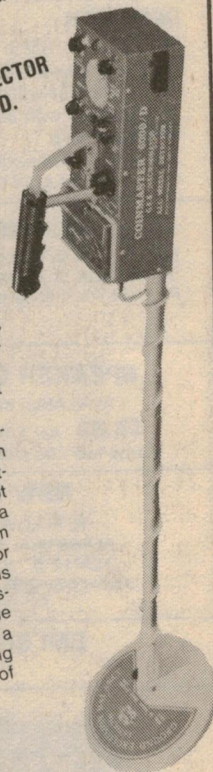
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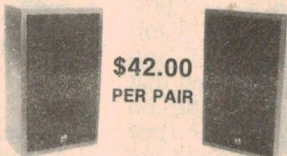
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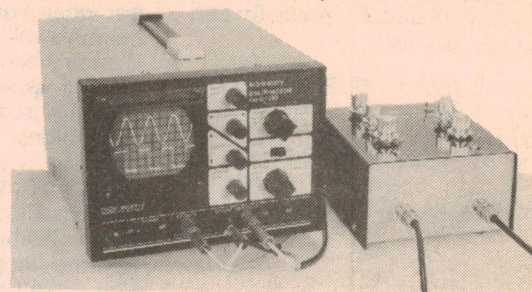
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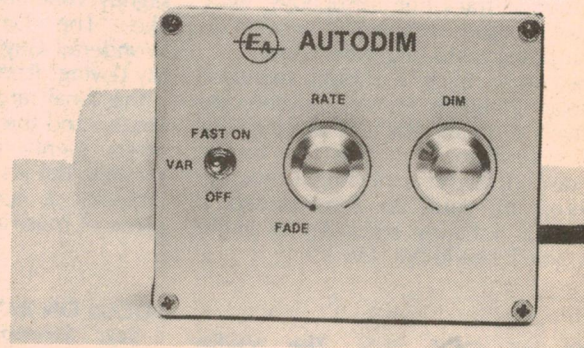


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\* Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles mentioned here.



## RECORDS & TAPES — continued

### THE BEST OF GEORGE SHEARING. Stereo, World Record Club WRC-R 06224.

This Club album is indeed a pleasant reminder of blind British pianist George Shearing. Drawn originally from the Capitol label, it contains a characteristic mix of studio and concert performances. The George Shearing quintet share in all tracks but, in some, they are augmented by a string choir conducted, in one instance, by Billy May.

The tracks, too, are a mix of sweet, swinging and jazz: *Roses Of Picardy* — *Early Autumn* — *East Of The Sun* — *September Song* — *Little White Lies* — *Honeysuckle Rose* — *Lullaby Of Birdland* — *September In The Rain* — *You Don't Know What Love Is* — *Jumpin' With Symphony Sid* — *Dream* — *You Stepped Out Of A Dream*.

Despite the assorted origin of the tracks, the quality is fairly consistent and

unmarred by significant noise or distortion. It makes for pleasant listening at a casual level, but devotees of George Shearing, and/or music of a past era, will discover added interest.

Add the biographical notes and you have an album which I am sure many will enjoy. (W.N.W.)

☆ ☆ ☆

### THE BEST OF RAYMOND LeFEVRE. Stereo, Barclay (Festival) L-37274.

On the French Barclay label, this is a happy album of show band music, which will appeal to anyone with an ear for slightly vintage middle-of-the-road numbers. There are 16 of them, all told, but Raymond Lefevre varies the style and the treatment from one to the other to forestall any risk of monotony. Here are the titles:

Mozart 40 — *Lady d'Arbanville* —

*Groovin'* — *Bridge Over Troubled Water* — *Soul Coaxing* — *Hey Jude* — *El Condor Pasa* — *Mamy Blue* — *Puppet On A String* — *Oh Happy Day* — *Whiter Shade Of Pale* — *Wanderin' Star* — *Raindrops Keep Falling On My Head* — *Those Were The Days* — *Adios Amour* — *Release Me*.

Here and there I noticed a touch of edginess in the strings but, generally speaking, the sound quality was okay. As I said, happy middle-of-the-road sound for those greying a bit around the temples. (W.N.W.)

For information on World Record Club albums, contact the club at 605 Camberwell Road, Hartwell, Victoria, 3124. Tel. 29 3636.

### LINGA LONGA MAX. Max Bygraves. Stereo. Astor SPLP 1579. (Also on cassette).

Max Bygraves is an artist who needs no introduction and, on this album, sings some great old-time favourites with style and feeling. You get 12 tracks (including 3 medleys), most of which are tailor made for a good old-fashioned sing-a-long session. Included are:

*Roll Roll Roll* — *Broadway Melody* — *Chicago* — *Picking Up Pebbles* — *Dance In The Old Fashioned Way* — *You Won't Find Another Fool Like Me* — *The Last Farewell* — *Second Hand Rose* — *Hard Day's Night* — *Shoe Shine Boy* — *Sound Of Music* — *Climb Every Mountain*.

Recording quality is average. (G.S.)

## Medium-size Allen Organs

ALLEN DIGITAL COMPUTER ORGAN. Systems 120 and 201. Organist Dr Charles Farley. Stereo, no brand, 29234. [From Allen Organs Aust, 32 Woodhouse Rd, Doncaster East, Vic 3109. Phone (03) 842 3465. Price \$5.85 incl. P&P.]

After several references to jumbo size Allen organs in cathedral situations, it is interesting to come back nearer to earth and to listen to a couple of instruments closer to our average lifestyle. Not that the Systems 120 and 201 are small by any other standards, with their twin 61-note manuals and full radiating 32-note pedal boards.

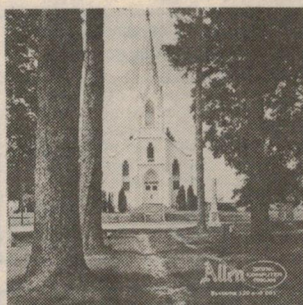
They are heard here in large regional churches, with no more than average ambience: the Zion Lutheran Church at Taylor Ridge, Illinois and the Homewood Evangelical Free Church, Moline, Illinois.

Dr Charles Farley, a very capable professional organist, presents a program which exposes the considerable capabilities of the two fairly similar instruments:

Processional (Mathias) — *Variations "He Leadeth Me"* (Baumgartner) — *Agincourt Hymn* (Dunstable) — *Meditation "Brother James's Air"* (Darke) — *Toccata in D Minor* (Bach) — *Carol "Greensleeves"* (Wright) — *Variations "Just As I Am"* (Baumgartner) — *Aria For Organ* (Malloch) — *Adorn Thyself My Soul* (Brahms) — *Prelude and Fugue in G Minor* (Dupre).

The tonal structure of the 120 and 201 is naturally less complex than that of the cathedral sized Allens, and the vibrato/tremolo effects hint more strongly at electronics; on the other hand, the voicing is unmistakably classical pipe.

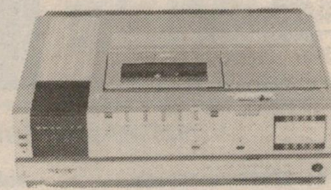
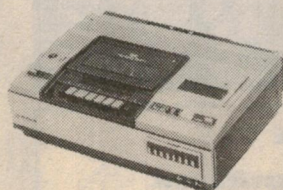
But, of course, the intention is that you buy the album and make up your own mind! (W.N.W.)



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How good is it? :- This part of our advertisement was typeset using an ET-121 driven by a TRS-80.

Define shifted keys to be BASIC commands, type in graphics directly from the keyboard and see them when you LIST and much more.

## EA

## CLARENCE PARK, ADELAIDE



# Sinclair ZX80 personal computer

Science of Cambridge Ltd, of the UK, has really come up with a world-first with the Sinclair ZX80. It is easily the smallest and least expensive computer available which will interface to a TV set and cassette recorder. It features full BASIC operation with powerful editing and single keystroke functions.

by JOHN CLARKE

The Sinclair ZX80 computer would have to be one of the most inexpensive on the market today, especially considering that it has programming features which would normally be found on only the more expensive systems. To have the machine up and running, a DC power supply and television set is all that is required. A domestic cassette recorder can also be used to store programs.

Measuring 175 x 35 x 218mm (W x H x D) and weighing only 340g, the ZX80 with its own integral keyboard is very compact. Housed in a white plastic case held together with plastic rivets it gives the general impression of lightweight construction. However, the fibreglass printed circuit board fortunately gives structural strength to the case.

At the rear of the computer case are three 3.5mm sockets for the DC power supply, tape recorder microphone and

earpiece. An RCA socket is provided for the RF modulator. Also a 46-way edge connector pad is brought out carrying the Address Bus and Data Bus, along with the Z80 control lines. This bus can provide for extra memory expansion boards. Leads are supplied for the cassette interface and RF modulator.

Opening the top cover to the computer case reveals a double-sided PCB, filling the whole area of the case. The touch sensitive keyboard is allocated the first 70mm of PCB depth. The two major ICs on the PCB, the NEC Z80 MPU and the Sinclair Research "Super ROM", are mounted in IC sockets while the remaining ICs, mainly 74LS TTL, are soldered directly to the board. A small heatsink is provided for the 5V regulator.

A crystal oscillator provides the 3.25MHz clock for the microprocessor and the 1K of read/write memory con-

sists of two 2114L RAMs. Incidentally, the RF modulator for the Australian version operates at VHF channel 1.

We used the 600mA/9V DC plug pack, which is available as an accessory, to power up the computer. Connecting the coax to our TV set, we were rewarded with a reassuring cursor, a black square with a white letter K in it, at the bottom left hand side of the screen. The screen characters appear on a steady display in reverse field video (black letters on a white background). The full screen contains 32 columns by 24 rows of characters.

One difficulty with using the ZX80 becomes immediately obvious. The keyboard lacks tactile feedback, preventing the user from touch typing. With a flat sheet of plastic as a keyboard it is necessary to continually watch the keys as they are pressed.

A further problem occurs when a key is pressed and accepted by the computer: the screen will lose synchronisation for a short duration, producing severe flicker. (This could perhaps be regarded as an advantage for some, in that this flicker indicates that the key just pressed was detected by the computer!)

Operating the cassette interface is straightforward, just press SAVE to store the program on tape and LOAD to retrieve the program. It was necessary to experiment with the volume settings of the cassette recorder before the SAVE/LOAD operation was completely reliable and we suggest that you experiment with the storing of short programs to perfect these settings before any serious storage of programs is done.

Writing programs with the ZX80 can be very quick, since the keyboard has what Sinclair describes as "Key Word" entry. This means that words such as LET, RUN,



Left: the Sinclair ZX80 in action. The ZX80 is easily held in one hand, yet features full BASIC operation and single keystroke functions.



# Sinclair ZX80 home computer

PRINT, GOTO, LIST etc, are printed on the screen with just one keystroke. This can be done without the use of any shift keys. Thus the syntax of the ZX80 BASIC allows one key to serve the two functions of printing key words and letters. Consequently letters cannot be used directly after a line number since the machine assumes that a keyword is required.

Two drawbacks are evident from the key word entry system. The first is that LET is not optional as it is with many other machines, but this disadvantage is far outweighed by the fact that all other key words are printed with only one key stroke. The second drawback is that only one instruction per line is allowed.

Running programs can be a problem if the quantity of printout expected will be greater than the screen can hold. When the screen is full from the printout of a program, an error message will be printed indicating a full screen. The only way to overcome this problem is to test for an approaching full screen and clear the screen ready for the next screen of display. This should be by way of a routine placed before the print statement.

All the available characters, including reverse video for those available on the keyboard, can be displayed with the use of the CHR\$ function and this includes graphics and some characters not directly available from the keyboard. There are 10 graphics characters accessible directly with the keyboard and with their reverse video gives 20 fairly standard symbols found on most other personal computers.

## ENTERING PROGRAMS

Microcomputers running interpreted BASIC usually display error messages when a mistake is encountered while running a program. The ZX80, however, will not accept a line which has a syntax error at the programming stage, rather than at the running of the program. Consequently the line will need correcting immediately, before the machine will accept the line.

The cursor shows what the computer is expecting to be entered next in the programming line. Initially, after the beginning of a program or new line, the cursor displays a K. This indicates the computer is expecting a keyword. After the line number and keyword has been entered, the cursor displays an L. This means the computer is now expecting a character. These two cursor symbols tell the operator that the computer will print either a keyword or character depending on the state of the cursor. In other words, it is an automatic shift.

Another cursor symbol is the S. This

means that a syntax error has occurred. This does not necessarily mean that there is an immediate error, but just indicates a potential error. For example, at the opening of quotation marks, an S will appear in the cursor indicating that these quotation marks will need to be closed before the computer will accept the line.

At the acceptance of a program line, the line is printed at the top of the screen and a cursor points to the line just accepted. This cursor is called the current line cursor. This cursor can be moved either up, down or left and right to facilitate editing a line. When the screen is full, the current line cursor hits the bottom line and the listing scrolls from then on.

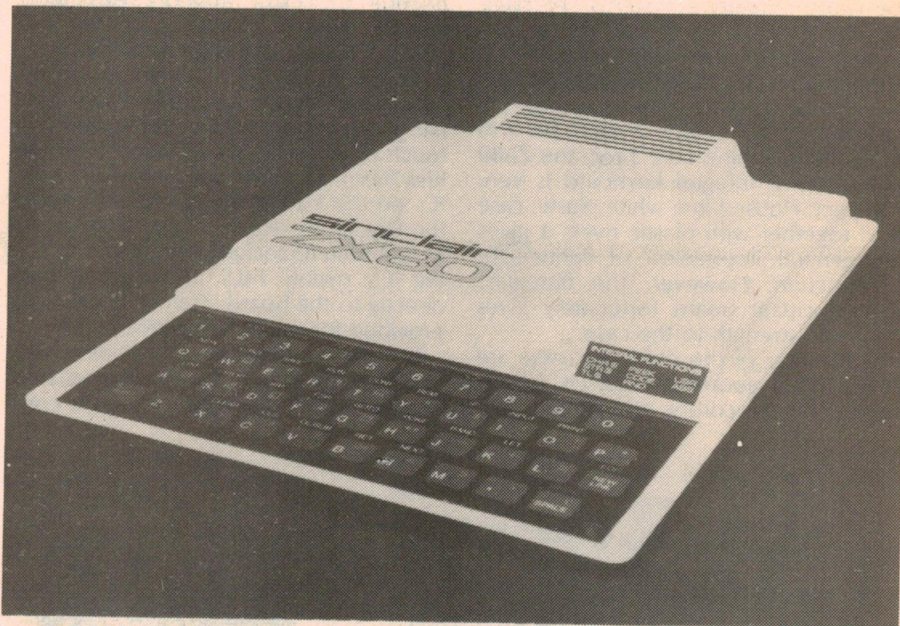
When running the program, errors can still occur, even though the syntax errors have been removed. The program will

capability. Up to 26 string variables are possible and can undergo all relational tests. Two unusual string functions are the TL\$ (string) which returns the string within the brackets less the first character, and the CODE (string) which returns the first character code number of the string. Another string function, in the form INPUT A\$, can request a line of text.

A unique and useful feature in the ZX80 BASIC is the capability of the GOTO statement to jump to a variable as well as a line number. This can be a powerful feature.

Only one statement per line is legal with the ZX80, but lines of unlimited length can be made in the form of extended boolean algebra expressions or PRINT statements.

The ZX80 has many of the useful BASIC



A close up of the ZX80 personal computer. Features include a touch sensitive keyboard, 1K of RAM, and an internal RF modulator for VHF Channel 1.

stop on encountering an error and list an error code. The error code is displayed as an error number followed by the line number at which the error occurred.

Perhaps the biggest drawback with the Sinclair ZX80 is that it will only perform integer arithmetic with five functions available: Plus, Minus, Multiply, Divide and Power. Results of division calculations are always truncated towards zero. For example, dividing nine by two gives a result of four.

Sinclair have a routine in their Operating Manual which allows floating point arithmetic to be performed but it is a little wasteful of the limited memory space.

The ZX80 has much string handling

statements available on more expensive machines. These are REM, RND, RANDOMISE, DIM, CLS, ABS and, to access the machine level of the machine, PEEK, POKE, and USR.

Sinclair claim that their ZX80 is faster than all other personal computers when compared with benchmark test programs. Subjectively, we found the ZX80 to be fast, but the fact that the machine only operates with integers gives the ZX80 a definite speed advantage over floating decimal point computers, making this faster speed rather academic.

The Sinclair Operating Manual, called "A Course in BASIC Programming," is quite descriptive in the programming features of the ZX80. It helps the begin-



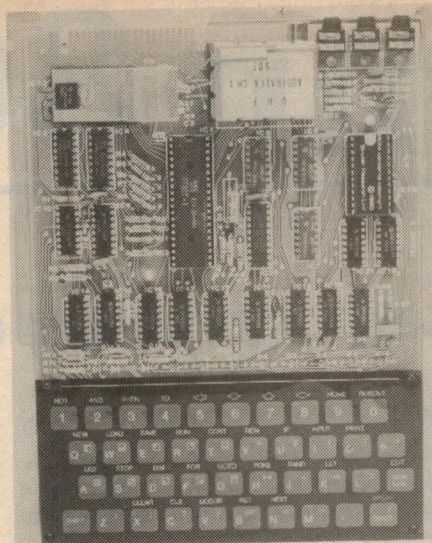
## CONCLUSION

ner to get started and operate the machine effectively. For people wishing to refine their BASIC programming, however, the manual does not really help. Either experience and practice will produce a good programmer, in time, or a good book on BASIC programming will speed up the process. As far as hardware information on the ZX80, this is given minimal treatment.

To sum up, we must report mixed feelings towards this computer from Sinclair. On the one hand it has many good features, especially the time-saving software, and some quite unique additions not found on other microcomputers. On the other hand, though, the computer has some shortcomings that render it less effective than its special features would indicate.

Clearly, the biggest feature is its very low cost. It is easily the least expensive BASIC personal computer which interfaces with a TV set. On that score, it just cannot be beaten by any other computer on the market. So for those wishing to learn BASIC programming for a small initial outlay, the ZX80 must be considered.

Memory expansion boards are available and many programs are available on cassette, ranging from



*Inside the Sinclair ZX80. Unlike other computers, the ZX80 will not accept a line which has a syntax error at the programming stage.*

games to education to utility packs.

Suggested retail price of the Sinclair ZX80 is \$295, which includes the ZX80 Basic manual and sales tax. Our review sample came from Rod Irving Electronics, 425 High Street, Northcote, Victoria. The Sinclair ZX80 is distributed in Australasia by Sinclair Equipment (Australasia) Pty Ltd, 308 High Street, Kew, Victoria, 3101.

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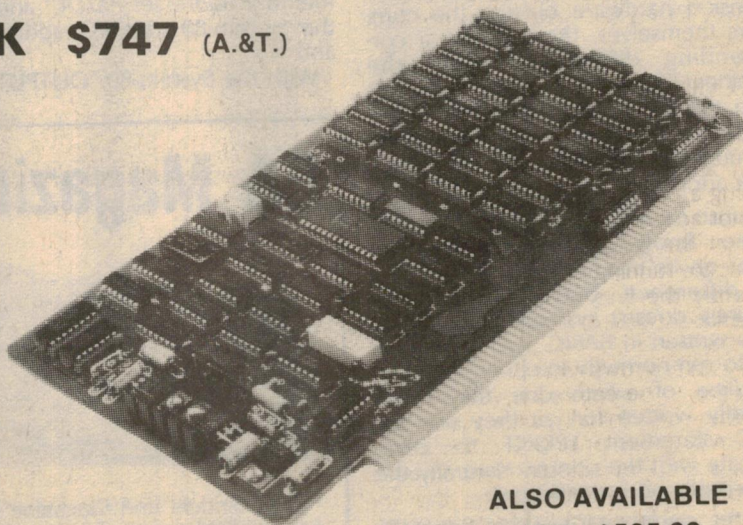
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# Column 80

by JAMIESON ROWE

Technical Director,  
Dick Smith Electronics

## System-80 & TRS-80 addressing differences

To conclude our discussion of the differences between the System-80 and TRS-80 computers and how they affect programs, we look this month at the differences which become apparent when the machines are expanded. These are differences in addressing for the printer and RS-232C communications ports.

There are further differences between the System 80 and TRS-80 which become apparent when the two machines are expanded. The first difference shows up when you wish to connect up a printer, either by using a low cost "printer interface" plugged into the rear of the machines themselves, or by using the printer port provided on their full Expansion Units.

Whereas the printer port on the TRS-80 is "memory mapped", and located at address "37E8" in memory space, the printer port in the System-80 is "I/O mapped" and uses I/O address "FD". In each case the processor must WRITE to the address concerned in order to send a data byte to the printer, and READ from the address in order to test printer status.

Note that although this difference in printer port address is primarily a matter of the logic connections provided in the expansion hardware outside the computers themselves, there is also a corresponding difference within the machines. The printer "driver" routines inside the BASIC interpreter ROMs are necessarily different, being written to communicate with the printer via the different addresses.

Because each BASIC interpreter's driver routine "knows" where to find the printer on its machine, this means that the difference between the two machines doesn't normally affect programs written in BASIC. Such programs tend to run normally in either machine, regardless of which one they were originally written for, as they use the BASIC statement LPRINT to communicate with the printer. Naturally the LLIST command is unaffected.

For the same reason, there generally isn't any problem with those machine language programs which again call the BASIC interpreter's printer driver routine, as you might expect. The only programs that are affected are programs which use their own printer driver routine. Examples of these are the Tandy

Editor/Assembler and "Scripsit" Word Processor.

Note, however, that although this means that the System 80 can't run some programs written for the TRS-80 without having to change the printer driver, the System-80 Expansion Unit does offer a very handy feature by way of compensation. It gives the user a choice of placing either the Centronics-type parallel port or the RS-232C serial port at the printer address "FD". This allows the use of a serial teleprinter in place of a parallel printer — so if you have an old teleprinter, you can save quite a deal of money!

The other difference between the two machines is in the addressing used for the RS-232C communication port. Here the addresses used for data and UART/status interfacing are again different. Whereas the TRS-80 uses memory addresses "37DE" and "37DF", the System-80 uses I/O addresses "F8" and "F9".

With the System-80, OUTPUT data to

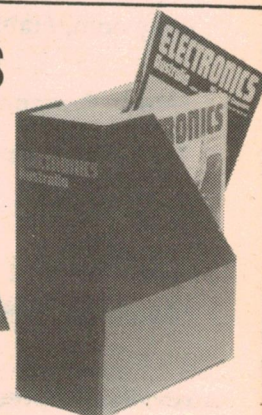
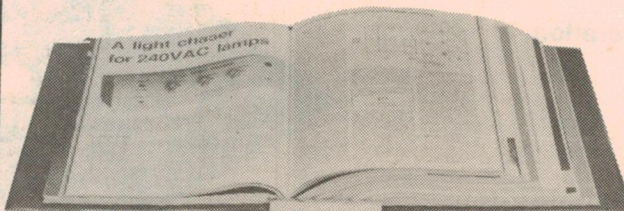
the UART is written to port F9, while INPUT data from the UART is read from port F8. Conversely output information for UART control is written to port F8, while input information on UART status is read from port F9. In the TRS-80, address 37DF is used for both input and output of data, while address 37DE is used for input and output of status/control information.

The differing addresses for the RS-232C port do not affect many programs, as in most cases the port is not involved in program operation. In fact, there are no specific BASIC commands for feeding data to and from the port, indicating its specialised role. Basically the only types of program which are affected are programs designed to turn the computers into communications terminals of one sort or another.

Because of the differences between the two machines, such programs are likely to need changing if they are to run on the machine other than that for which they were written. But as you can see, the changes are not likely to be great, involving but a few minutes' work for a reasonably experienced programmer.

Well, that completes our comparison of the two machines. Next month, we'll look at something rather different: programming languages. In the meantime, best wishes for a Merry Christmas! ☺

## EA Magazine Holders



The binders and magazine holders are available over the counter from Electronics Australia, 57 Regent Street, Sydney, NSW — Price: \$5.10 binders, \$4.50 holders.

Mail orders should be sent to Electronics Australia, PO Box 163, Beaconsfield, NSW 2014.

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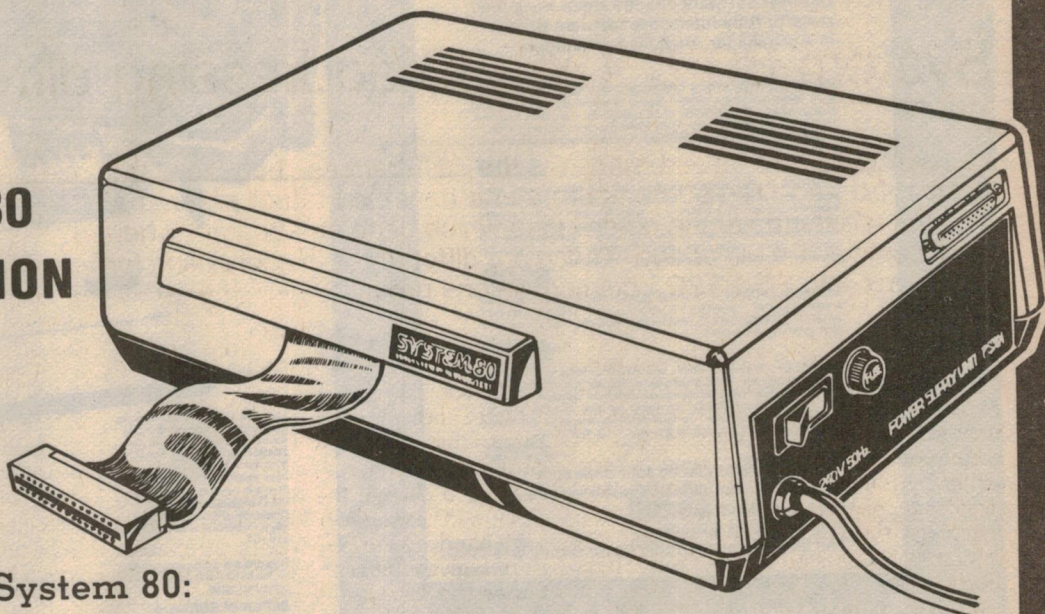
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### BUSINESS NEWS

Microcomputers like the TRS-80\* are really elegant pieces of hardware. The price is deceiving. Given the right programs, they can jump through hoops.

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Please send me the following programs at \$99.95 each:

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Accounts Receivable	
General Ledger (add \$50 for Cash Journal)	
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APL - A Short Course	\$15.50
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SNOBOL 4 Programming Language	\$18.25
GENERAL	
Computer Fraud & Counter Measures	\$39.95
A Collection of Programming Techniques	\$19.95
Word Processing	\$19.95
Introduction to Word Processing	\$19.95
INTERFACING	
TRS-80 Interfacing	\$11.95
280 Interfacing Book 1	\$29.75
280 Interfacing Book 2	\$29.75
Interfacing the 6802	\$19.95
Microcomputer Interfacing	\$25.75

\* Used & Demo TRS-80's (Model 1 and Model 2) in stock; also disks, expansion interfaces etc.

## Word Processing deForest Style



Using the best in word processing software the Magic Wand™, the best in letter quality printers the DIABLO, and the well-known TRS-80™ MOD II. You have looked and looked for the best and now it is available from the Complete Computer Company, deForest Software. Word Processing at its best from \$10,400.

Magic Wand available separately for the MOD II and other computers \$450.

deForest Software

26 Station Street, Nunawading, Vic., 3131. Phone: (03) 877 6946

Magic Wand is a trademark of Small Business Applications, and TRS-80 is a trademark of Radio Shack.

Why buy a dedicated word processor when for less money you can have a complete computer system!!

## Why settle for IMITATIONS

WE HAVE A NUMBER OF AS NEW TRS 80s IN THE STOCK LEVEL 2, 16K FOR ONLY

**\$850.00**

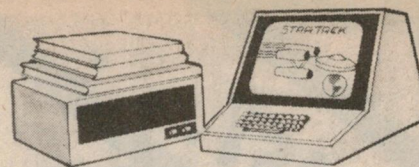
THESE UNITS ARE UNMARKED AND CARRY A 90-DAY WARRANTY

## deForest Software

26 Station Street,  
Nunawading, Vic 3131.  
Phone: (03) 877 6946



# Microcomputer News & Products



## Compukit 101 single-board computer

Here is a kit computer to really excite microcomputer enthusiasts. Called the Compukit 101, it comes with up to 32K of RAM, a full ASCII keyboard, RS232 and cassette interfaces, and is programmable in Basic. You don't have to be a genius to build it or to operate it!

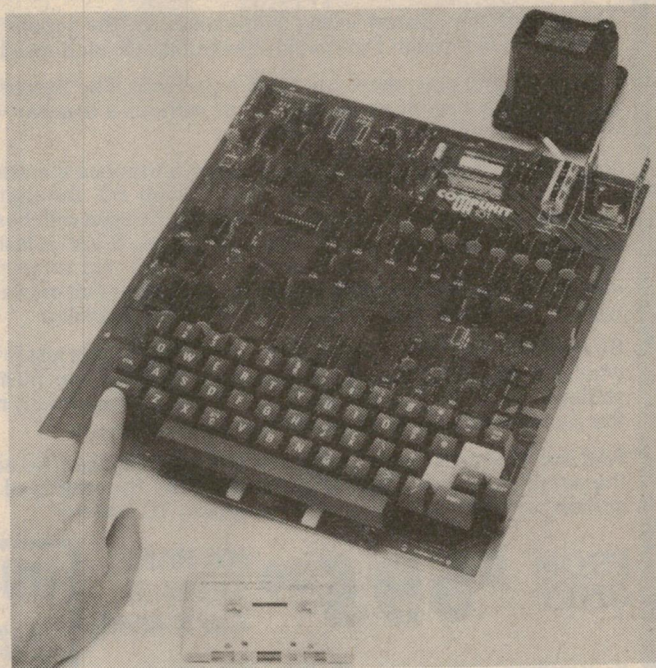
Based around the powerful 6502 microprocessor, the Compukit 101 is supplied with 8K Microsoft Basic in ROM.

Included as standard with the unit is 4K RAM on board, expandable up to 8K on board, which is sufficient for most requirements including game playing. In fact, a "Space Invaders" program will be supplied free if the extra 4K RAM add-on is ordered with the kit. Maximum memory configuration is 32K using an extender card.

The Compukit 101 comes with a 40-line expansion interface socket for attachment of extender cards, which may contain additional memory, disc controllers or sound synthesisers. An RS232 interface is provided to allow connection to a printer, while a Kansas City tape interface enables the user to save programs using a cassette recorder.

A separate controller exists on-board to control the display independently of the 6502 microprocessor, and this has its own dedicated memory (1k RAM). This means that any portion of the display can be quickly and easily accessed or changed, enabling exciting fast-moving games and displays. The keyboard is a professional 52 key Qwerty keyboard, using standard ASCII notation.

An on-board VHF modulator enables connection to any standard Australian television set — b&w or colour (although the display is in b&w only). Both upper and lower case characters are provided in the extensive 256 character set, which also includes mathematical symbols and special



graphics shapes. Access to the 6502 machine code is made possible through a powerful 2K machine code monitor.

The Compukit 101 kitset includes the power supply, all parts, and a comprehensive construction manual. It is available only by mail order from Melbourne House (Australia) Pty Ltd, 24 Peel St, Collingwood, Victoria 3066. Cost of the basic kit is \$595, including sales tax and postage.



## SYSTEM-80 + TRS-80 OWNERS!!

FREE POSTAGE IN AUST — SEND FOR FREE LIST

### CHRISTMAS SPECIALS

\* THE FAMOUS NEW DOS + 35 TRACK NOW ONLY \$99 \$79

\* BEAT THE PRICE RISE, QUALITY VERBATIM DISKS TO CLEAR! \* TANDY + SYSTEM-80 NEWSLETTER \$12

Adventure Land	15.00	Mastermind	9.00	Basic Statistics	21.00	Micro Text Editor	11.00	Comprom	20.00
Adventure Pirates	15.00	Mission Impossible	16.00	Biorythms	6.00	Mortgage Calculator	9.00	Dosort	35.00
Air Raid	16.00	Othello	7.00	Calendar Functions	9.00	Math Drill	6.00	D.S.M.	75.00
Atlantic Balloon race	11.00	Pentominoes	11.00	Compress IT	27.00	Numerical Integration	9.00	DATA/MNG MNT/SYST	75.00
Alien Invasion	17.00	Park Barrel	11.00	Cash Register	11.00	Personal Finance	11.00	DCV-1	10.00
Backgammon	9.00	Remainder	9.00	COPY SYSTEM tape	15.00	Pre Flight	21.00	ELECTRIC PENCIL	140.00
Barricade	16.00	Robots	7.00	Complex Mathematics	9.00	Renumer 16, 32 or 48K	15.00	Final Approach/Space Battle	26.00
Baseball	9.00	Round The Horn	11.00	Electronics Assistant	11.00	Remodel	25.00	Inventory 2.3	80.00
Bingo	7.00	Safari	9.00	ELECTRIC PENCIL	95.00	Remodel & Proload	35.00	Mail List II	99.00
Batter Up	17.00	Santo Paravia	9.00	ESP Tester	7.00	RSM-2 Monitor	28.00	NEW DOS + 40 TRACK	110.00
Battleship	16.00	Sargon II Chess	37.50	File Handling	9.00	R.P.N. Calculator	11.00	ST-80 D	80.00
Bridge Challenger	9.00	Space Battle	16.00	Finance (Loans/Invest)	9.00	Spooler	26.00		
Cribbage	8.00	Startrek 3.4 (new)	16.00	Graph Plotter	12.00	Statistics	11.00	<b>Books</b>	
Checkers	8.00	Taipan	11.00	GSF Fast Sort	25.00	Tiny Compiler	25.00	Osborne/McGraw-Hill	
Concentration	9.00	Tarot Cards	11.00	General Accounting	16.00	Timer Curve Fitting	15.00	Gen Ledger	20.00
End Zone	9.00	Ten Pin Bowling	9.00	Ham Radio	11.00	Trig Package	9.00	Accts Rec/Accts Pay	20.00
Fast Gammon	16.00	Time Bomb	6.00	Home Finance	11.00	8800-280 Conversion	16.00	Pennington TRS-80 Disc	
Galactic Blockade	9.00	Treasure Hunt	9.00	Infinite Basic	50.00	<b>Disk</b>		& Other Mysteries	30.00
Hamurabi	7.00	Tycoon	9.00	Infinite Business	30.00	Osborne/McGraw-Hill Complete Integrated BUSINESS/ACCOUNTING system, Accts Rec/Accts Pay/Gen		<b>Hardware (Prices Incl S/T)</b>	
Hangman	9.00	X-Wing fighter	9.00	Inventory Control	13.00	Ledg/Cash Journal each	90.00	10 Verbatim Disks	46.00
Kamikaze	9.00	Warfare I	9.00	Inventory (Mod)	21.00	Typing tutor	22.00	10 x C10 CASSETTES	7.00
Keno & Game of Life	14.00	Accounts Receivable	26.00	Inventory (FP)	25.00	Advanced Personal Finance	26.00	Suppressor Plug	7.00
Kentucky Derby	7.00	Appointment	11.00	Keyboard 80	11.00	Amateur Radio System	26.00	Gold Edge Connector	13.00
L2 Games (Star Trek etc.)	12.00	APL-80	35.00	KVP Extender	26.00			Agents for: TSE, MA, Racet, SSS.	
Lunar Lander	9.00	Basic 1P (LII to LI)	26.00	Linear Programming	9.00				

PITT ST. MICROCOMPUTERS Box A344 Sydney South, Pitt St, Sydney 2000. Ph 569-8228.



AT LAST...

# THE SYSTEM 80 IS REALLY A SYSTEM!

## NOW YOU CAN BUILD YOUR SYSTEM 80 INTO A SUPERB COMPUTER SYSTEM...

This is Australia's fastest selling microcomputer: the superb System 80 available only through Dick Smith Electronics (& authorised re-sellers).

However, until now, there has been a problem. The System 80 hasn't really been a system at all. Like a car without a tow-bar: useful, but limited in what you could do with it.

Now all that has changed: we're proud to announce the release of the System 80 Expansion Interface. The System 80, through its S-100 expansion interface, now has the potential to be used with hardware and software devices from over 200 manufacturers. S-100 is fast becoming the industry standard, which means you aren't tied to any single one supplier for add-ons. A single supply source means that prices can — and usually are — sky-high because there is no competition.

So now we expect the System 80 to really boom — not just to hobbyists, who've had it all their own way until now — but to businesses, to students, to housewives, to industry... There are virtually no limits to the System 80 system. All it takes is imagination.

And don't forget: software requirements for the System 80 are virtually the same as for the TRS-80: so most of the thousands of programs written for it will also run on your System 80 system!



**SAVE  
HUNDREDS OF  
DOLLARS OVER EQUIVALENT  
COMPUTERS AND HARDWARE!**

**FROM ONLY \$695<sup>00</sup>** (4K RAM, LEVEL II Cat X-4003)

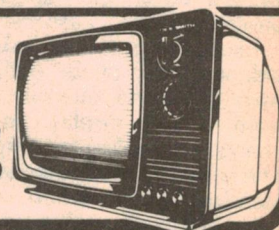
**16K RAM, LEVEL II \$750<sup>00</sup>**  
MODEL (Cat X-4005)

### BUDGET MONITOR

The System 80 will run with any TV set: but in case you need a monitor, check this one out! P.S. This monitor will also work with most other microcomputers. Compare our prices and **SAVE!**

USE WITH  
ANY  
COMPUTER!

**\$149<sup>50</sup>**  
Cat X-1196



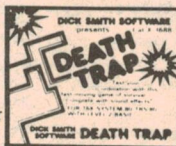
## NEW SYSTEM 80 SOFTWARE —

### FOR FUN & EDUCATION

Here are five recently released software tapes for the System 80 (also suitable for the TRS-80 Level II). They're fun to play and they're educational, too.

#### X-3688 "DEATH TRAP"

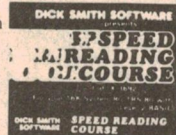
In this fast-moving realtime graphics game you have to control the motion of a constantly-moving point on the video screen and avoid randomly-appearing "mines" until an "escape window" appears. You can't cross your own trail, or hit the sides of the screen either. If you escape, you get further tries — only it gets tougher! Has sound effects. Requires 16K.



**\$9.95**

#### X-3692 "SPEED READING COURSE"

A set of programs supplied on two cassettes, designed to help readers of all-ages to improve their reading skills. The programs have been developed from the West Australian Reading Development Scheme. Requires 16K.



**\$19.95**

#### X-3694 "LEARNING FUN 1: SCURVE INVADERS"

Combines basic maths drill with the ever-popular "Space Invaders" game. Before being able to take each shot the player feeds in the "correct data". Sound effects, three levels of difficulty. Requires 16K.



**\$9.95**

#### X-3696 "LEARNING FUN 2: HANGMAN/CONCENTRATION"

Two programs. Hangman is complete with animated graphics "man" getting hung. The words chosen by either the program or a second player. Concentration: two players or teams have to match prizes behind numbers on the screen, then try to guess the mystery food word. Requires 16K.



**\$9.95**

#### X-3698 "LEARNING FUN 3: ALPHABET COUNTDOWN/RHYME TIME"

In Countdown sets of words taken at random from a large group must be placed in alphabetic order. Rhyme Time displays a series of unfinished rhymes, and the player has to type in the missing word from the clues given in the rhyme itself. Requires 16K.

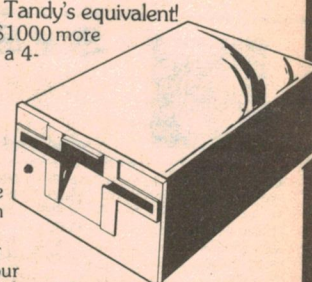


**\$9.95**

## BARGAIN PRICED MINI DISK DRIVE

\$200 less than Tandy's equivalent! You'd pay over \$1000 more from Tandy for a 4-drive system!

This incredible drive is world-famous Pertec brand; offers higher capacity than Tandy drive and will work with System 80 or TRS-80. Ask for more info. at your nearest Dick Smith store!



X-3230

**\$379**

## DISK PRICES TUMBLE!

Unbelievable prices for either hard or soft sector mini diskettes. Suit virtually all disk drives available. Buy from Dick and save a fortune!

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Soft Sector (X-3510)

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welcome

**WERE \$5.95 EA! NOW:**

1 - 10: \$4.95

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100 UP: \$3.50



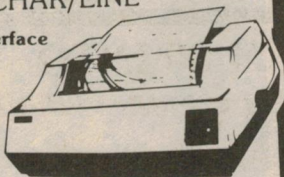
## ITOH 8300P BUDGET PRINTER

For budget printing, you can't go past this one! Uses standard tractor-feed paper, gives high quality print from its 7x5 dot matrix. Up to 240mm paper, prints 125 chars/sec. For either System 80 or TRS-80. Cat X-3255.

40/80/132 CHAR/LINE

Uses Printer interface  
and cable below

**\$970**



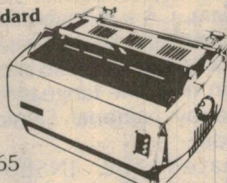
FAN-FORM COMPUTER PAPER  
TO SUIT ABOVE PRINTER. 2000 SHEETS.

Cat X-1189. **\$35.00**

## LETTER QUALITY DAISY WHEEL PRINTER

For top quality print, try this: it's over \$300 cheaper than Tandy's daisy-wheel, and is capable of proportional printing! Limited stocks

Takes standard  
stationery!



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**\$1995<sup>00</sup>**

## PROGRAM CASSETTES

Popular C-10 computer cassettes (just the right size for programs!) with computer-quality tape. Suitable for all 'compact cassette' type units (which everyone uses!) Cat X-3500

**\$1<sup>95</sup>**



## SAVE A FORTUNE ON MEMORY IC'S

Were almost \$100 more twelve months ago! Fast 250nS 4116 RAMs, for upgrading your 4K or 8K to 16K, 16K to 32K or 32K to 48K. 8 IC's in pack. With full instr. Cat X-1186



**\$59<sup>95</sup>**

Also available individually:  
Cat Z-9310 ... \$7.90 ea.

## DON'T NEED FULL S-100 EXPANSION?

Use this parallel printer interface if you don't need full S-100 expansion. Save a bundle! Uses similar connecting cable to S-100 interface

**\$49<sup>50</sup>**

## PRINTER CABLE

Cat X-4013

Fitted with edge connector at one end, 57N-36 plug at other: suits virtually all Centronics-type printers. Use with either S-100 interface or parallel printer interface.

**\$39<sup>50</sup>**

Cat X-4014

## SOUND OFF

Add sound to your System 80 programs! Includes amp, programs and full instructions. You can add sound to existing programs too! Also suits TRS-80.



**\$19<sup>50</sup>**

Cat X-3648

## MICROSOFT™ EDITOR/ASSEMBLER PLUS!

Editing, assembling & debugging power you've never had before! Equivalent of Tandy's Editor/assembler and T-bug products but in one package and at less than half the price! And it's far more powerful! Suits System 80 & TRS-80.

## EDITOR/ ASSEMBLER PLUS



**\$39<sup>95</sup>**

Cat X-3680

## LIGHT PEN BARGAIN!

The best value around. Gives your System 80 or TRS-80 an eye. Easy to use, has simple programs

**\$9<sup>95</sup>**



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Want to know more about our computers? Or are you having troubles? We've set up a special computer 'hot line' just to help you out. Call between 9AM & 5PM on Sydney (area code 02)

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## SOFTWARE for System 80 or TRS-80 GAMES AND EDUCATIONAL SOFTWARE CURRENTLY AVAILABLE

**TIME TREK** ..... **\$17.95**  
You're boldly going where no man has gone before ... Mind you, those pesky Klingons attack you from time to time, so you'll need fast reflexes as well as sharp wits. Nine levels of difficulty. Cat X-3650

**STIMULATING SIMULATIONS** ..... **\$17.95**  
No less than 10 different games: all fascinating and original. Art Auction, Forest Fire, Monster Chase, Nautical Navigation, Lost Treasure, Business Management, Gone Fishing, Rare Birds, Space Flight and Diamond Thief. Cat X-3652

**ELECTRIC PAINTBRUSH** ..... **\$17.95**  
This is a special machine language 'graphics interpreter' program, which lets you program dazzling graphics displays using simple high-level commands. Easy—and fun! Cat X-3654

**BRIDGE CHALLENGER** ..... **\$17.95**  
Keen on Bridge? This game never gets tired of playing with you. Ideal for practising and improving your level of play—whether you're an expert or just a beginner. Needs a 16K machine. Cat X-3656

**MICROCHESS** ..... **\$22.50**  
Think you're a wizz at chess? This program will put you to the test! But think out your moves carefully: the computer is out to beat you! One of the top selling chess programs in the USA. Cat X-3658

**BLOCKADE** ..... **\$17.95**  
You'll need fast reflexes and good co-ordination for this one. It's written in machine language so it can give really high speed graphics. Try to force your opponent into a collision with a moving wall: without running into a wall yourself! Cat X-3659

**PUNTER'S DREAM** ..... **\$12.50**  
Place your bets, please the race is about to start! Study the form of the various horses before placing your bets. Then the race is on! The program looks after the 'betting accounts' of up to nine punters, and can even cream off a percentage for the 'house'! You get a realistic simulation of racetrack probabilities. Use it for fun: or to improve your strategies! Needs a 16K machine. Cat X-3660

**BANDITO** ..... **\$14.95**  
Like playing the one-arm bandits down at the club? Here's one you can play seated at your friendly System 80! Tell the machine how much you want to spend, and it will feed it through. Watch the handle go down, the reels spin, and your money go! Then experience that familiar thrill when you hit a jackpot. Needs a 16K machine. Cat X-3661

**MATHS/SPELLING** ..... **\$9.95**  
Here's a great way to coach spelling and maths: imagine how much more interesting the lessons are if the computer is giving the problems! Help stamp out illiteracy and poor spelling—this great program can help you do it! Cat X-3662

**AIRMAIL PILOT** ..... **\$12.95**  
You're back in the early days of aviation. You must get the mail through in the shortest possible time. Your cloth-covered bi-plane must take you through unpredictable winds and electrical storms—can you make it? Cat X-3663

**INTERLUDE** ..... **\$22.50**  
This is the adults-only game for your computer. After the kids have gone to sleep, let the computer give you ideas for the rest of the night! It comes with a 'comprehensive' instruction manual! (Note: this program is NOT available to any person under 18 years of age). Do not purchase this program if you are easily offended. Needs a 16K machine. Cat X-3675

**SIMUTEK 1** ..... **\$17.95**  
Not just one, but FIVE superb space fantasy games. Includes Graphic Trek 2000 (try to dock the Enterprise with the space station without being shot down), Invasion Worg (protect the Earth), Star Wars (get in to the Death Star, plant a Bomb and get out again!), Space Target (a battle game) and Saucers (an action graphics game). Complete with instruction book. Needs 16K. Cat X-3685

**POKER PETE** ..... **\$15.95**  
Like a game of poker? He's a pretty shrewd player—hard to beat, although it can be done. Has really intriguing graphics: needs 16K machine. Cat X-3664

## NOW AVAILABLE SYSTEM 80 TECHNICAL MANUAL

48 pages of data, technical information, service data, minor modifications, etc. etc. Great for technically minded people with their own computer.



**\$14<sup>95</sup>**

Cat. B-6210

# DICK SMITH ELECTRONICS

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## SORCERER OWNERS

### A BETTER BASIC!!

The new software source MOD 1.01. Makes your basic into a superbasic with capabilities that outstrip even some disk basics.

- \* Full input checking to eliminate syntax errors and line overflows
- \* Redo from start if type mismatch in input statements
- \* Save numeric arrays with confidence
- \* Full line editing on input-change part of a line without retyping it
- \* Full selective renumbering — move your subroutines around; make a hole to insert more text
- \* Delete any block of lines
- \* Full recovery of program after accidental reset
- \*\*\* Available only for Exidy standard basic version 1.0\*\*\*

Basic mod 1.01 (include Rompac with order): ..... \$125.00

Use your Sorcerer's graphics capabilities!!

### GRAFIX

Just released! This tape-based machine-language program allows instant definition of graphic characters. Powerful macro command allows you to define 24 characters as a block. Numeric keypad becomes a special keypad for drawing lines and curves. Inverse, flip, rotate, tilt, mirror or translate characters. Study the makeup of any character. Easy-to-read 17-page booklet explains exactly how Sorcerer graphics work and how to define your own shapes.

Grafix ..... \$24.50

### SPELLBINDER

The super disk wordprocessor that talks directly to your disks. No drivers to install. Automatically centres titles. View right-justified printing on the screen just as it will be printed. Alternating left and right margins! And much more... simple to use.

Specially configured for sorcerer (requires CP/M) ..... \$299.00

We have an extensive range of hardware and software for the Sorcerer. We can offer memory expansion and disk expansion at reasonable rates. We are experts on Sorcerer, and offer full advice on compatibility of peripherals. Write for free catalogue.

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Features vinyl leather inlay, plenty of space for cassettes, disk drives, S100 or any other busses.

Feed slot for printer paper, two deep spacious drawers for convenience. Put an end to those backaches from hours of out of position programming.

Send cheque or money order to value of \$170.00 to **D.J. GILLIN**, 170 Moore St. Warrnambool, Victoria 3280. Delivery free in Victoria. Telephone (055) 62 4376 Subsidised freight interstate an ideal Christmas gift.

Chair and equipment not included.

## Microcomputer News & Products

### Single-chip Micro has Tiny-Basic

Santa Clara, CA — A revolutionary new 8-bit single-chip microcomputer that speaks in a high-level Basic-like language rather than machine language has been developed by National Semiconductor Corporation.

Designated the INS8073, the microcomputer is the newest member of National's Series 70 of bus-oriented single-chip 8-bit devices and executes a high-level language called NSC Tiny Basic directly on-chip.

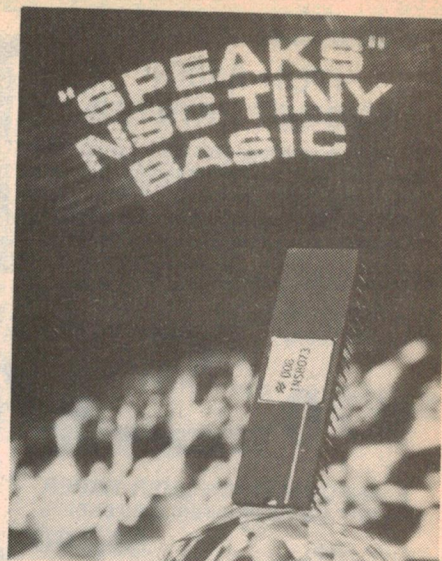
The 40-pin INS8073 incorporates both on-chip RAM (64 bytes of scratchpad memory) and on-chip ROM (2.5k bytes on which the NSC Tiny Basic interpreter is stored). In addition the device contains an 8-bit arithmetic logic unit, an 8-bit accumulator, an 8-bit extension register, plus four internal 16-bit registers.

The INS8073 has 16 address lines and eight data lines, allowing easy system expansion using standard peripherals. Separate Read and Write strobe outputs from the INS8073 indicate when valid input/output data are present on the 8-bit data bus. The remaining I/O lines are

dedicated to initialisation, bus management, interrupt request, I/O cycle extension, and software controlled I/O.

Although the execution time of the INS8073 using NSC Tiny Basic directly in the production system is slower than that obtained using optimised machine languages, the vast majority of applications of single-chip microcomputers is not very time critical. Some control oriented jobs such as instrumentation and process control can be performed at a 10th of the speed of most present generation single-chip microcomputers.

Enquiries to NS Electronics, PO Box 89, Bayswater, Vic 3153.



## Shortage of Computer people

A shortage of computer maintenance personnel could become a serious problem in Australian manufacturing. This was one of the key points stressed by Mr Richard Wander at a series of one-day seminars held recently in Sydney, Melbourne, Adelaide and Brisbane.

The seminars, entitled "Microprocessors — Their Use in Engineering", were jointly sponsored by the Production Engineering Research Association of Great Britain (PERA) and the Metal Trades Industry Association. Their aim was to make management aware of the basic technology, construction and use of microprocessors and to provide an opportunity for a discussion of the economics and problems of their introduction into industry.

Speaking on the future development of microprocessors in manufacturing, Mr Wander told seminar delegates: "As in the UK, Australian manufacturing concerns will have to face the problems of how to keep their computerised equipment running in the face of a desperate shortage of trained maintenance technicians."

He said that if Australian manufacturers did not prepare themselves, they could soon be in a situation where a



Mr Wander with PET

breakdown of computerised plant could have very serious consequences simply because there were not "sufficient indigenous skilled people to go on to the shop floor and get the plant going again."

Mr Wander stressed the need for Australian industry to become more internationally competitive by introducing microprocessor technology. He said Australia was ready for this changeover, indeed it had to be ready, "because the so-called third world countries are beginning to use microprocessors and they also have very low labour rates."



# BUILD A COMPUTER FOR XMAS FROM \$399

To Me  
from Santa



Discover the exciting world of microcomputers, profit from programming and applying these technological wonders. With the Applied Technology MICROMODULE family you can learn as you build these affordable, versatile and powerful kits. Based on the popular Z80 microprocessor and the industry standard S100 bus, MICROMODULES can be built up to any configuration from a simple 2 board system (INSTRUCTOR 80) to 64K systems with floppy disks, high speed printer suitable for process control, word processing and business systems.

## INSTRUCTOR 80

The ideal starter system comprises DGZ80 kit with 1K RAM and DGOS ROM operating system; DG640 VDU kit, full function ASCII keyboard, 3 slot mother board and 2 x S100 sockets. Full assembly manuals are included, together with a simple programming course and sample programs to run. You add a simple power supply (8V) and a modified TV set and you have a complete computer system.

## INSTRUCTOR 80 KIT

\$399.00.

## SOFTWARE

Microworld 12K Basic for Z80. If purchased with DGZ80.  
Microworld Editor/Assembler.  
Games Pack 1. (Target, Trek).  
Utility Pack 1.  
PCG Chess (If purchased with PCG).

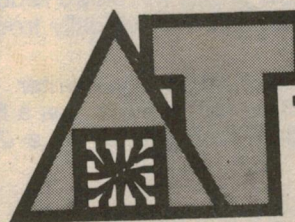
\$14.75.  
\$14.75.  
\$14.75.  
\$14.75.  
\$5.50.

NOTE. PRICES INCLUDE SALES TAX. Specifications and prices subject to change without notice.

## MICROMODULE FAMILY.

### HARDWARE.

DGZ80 CPU Kit with 1K RAM	\$199.25.
DG640 VDU Kit - 64 characters x 16 line format, upper/lower case and graphics	\$149.50.
TCT 16K EXPANDA RAM using static RAMS.	
- with 4K RAM.	\$139.50.
- with 8K RAM.	\$179.50.
- with 16K RAM.	\$259.00.
TCT PCG (ETI June 1980) adds fine graphics to DG640	\$140.00.
SCVT-100 (EA Oct 1980) Serial Terminal.	\$189.50.
2650-S100 2650 on the S100 bus.	P. O. A.
JC100 9 slot mother board plated through holes and provision for power supply.	\$49.50.
JC200 Card Frame for JC100 mother board.	\$49.50.
JC300 S100 Power Supply 8V/8A, 15V/15V 2A with computer grade components.	\$67.50.
SECI Cassette Interface.	\$24.50.
EA/MODEM 300 BD Modem Kit (See EA September 1980)	\$69.50.
Clare C70 Keyboard.	\$165.00.



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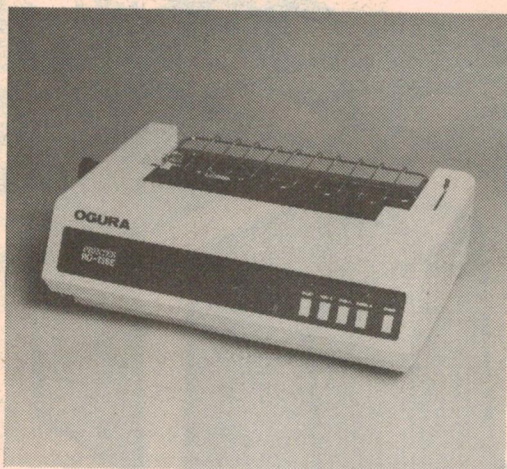
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AT.004



# OGURA PRINTER

## RO-136E



### Basic Specifications:

- Printing speed 120CPS bidirectional
- Character size 7 (length) × 9 (width) (Standard)
- Character type ASCII 128 characters
- 128 (136E) or 64 (80E) special characters can be added as an optional feature
- Character spacing 10 characters/inch
- Line spacing 6 or 8 lines/inch (switchable)
- Form width 5-15 inches (136E)
- 5-9 inches (80E)
- Copies Up to five copies including the original
- Paper feed speed 88m sec/line (6 lines/inch)
- Paper feed mechanism Tractor feed (continuous form)
- A slip may also be used
- Data input 8 bit parallel Centronics compatible RS-232C I/F.
- TTY 20mA current loop I/F. A variety of specifications can be applied by controlling the interface.
- Power 50/60Hz 100V ±10% 160VA
- Inked ribbon 13m/m (width) × 13m (length) (Black cartridge)

### Graphic Data RO-136G

The printer can print graphic data by controlling printing on a dot basis of up to 960 dots across the page.  
Speed — 80CPS.

## New Dot Printer Featuring Low Cost, High Performance, and Versatility

The OGURA RO series incorporating a microcomputer, is a low-price, high-performance serial dot printer featuring high reliability and a variety of applications.

It can be used in combination with a microcomputer, a small-scale computer, or as a CRT hardcopy device.

"Ogura RO Series" aims at dispersion of printers.

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The new generation electric typewriter is here! And it doesn't have a golfball. Olympia Whisperdisc. A super-quiet fully electronic typewriter with a simple, trouble-free typing disc to give you an almost perfect image.

A self corrector lets you remove up to eight characters by pressing a single key. The disc can be changed in seconds to a different typeface. The low profile keyboard reduces strain. And, being electronic, Whisperdisc is virtually trouble-free.

SME can now supply the ES100 Typewriter fitted with RS232C Serial Interface. This unit is known as a ES100P, it can interface to all standard computers via a 25-way 'D' connector.

Please contact SME for more information.  
\$1950.00



See page 114 for our new address.

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## Microcomputer News & Products

### Hartley 3900 System officially launched

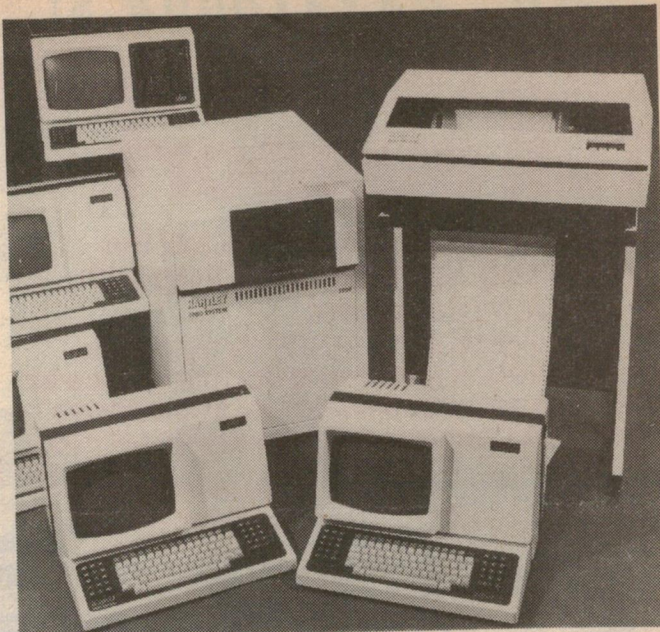
Hartley Computer Applications has confirmed its entry into computer hardware manufacture with the official launch of the Hartley 3900 System.

The three models in the series range from the 3901 Intelligent Terminal to what Hartley calls "a powerful system heart" — the 3909. In the middle is a stand-alone, floppy disk based mini, the 3905.

All models in the 3900 System make extensive use of new 16-bit microprocessors and offer speed and capacity features not found in most commercially available microprocessor based systems. The 3900 System is believed to be the first commercially available system to take full advantage of 16-bit microprocessors.

Features of the Model 3901 include 32K of RAM, 12K of ROM and a detachable keyboard that is connected to the VDU by a cord. A serial printer interface comes as standard. Model 3905 incorporates an additional 16-bit microcomputer and 128K of RAM and

*Pictured at right is the full 3900 series from the Australian manufacturer Hartley.*



comes complete with a pair of mini floppy drives integrated into the cabinet to provide nearly 700K bytes of on-line storage.

The 3905 comes complete with a Hartley designed Operating System and what is claimed to be the most powerful, application-orientated version yet of the Basic language — Hartley calls it Commercial Basic.

Like the 3905, the 3909 uses 128K

memory as standard with the capacity to go up to one megabyte through a fast 20-bit addressing scheme. Four users may be handled within the 128K with memory and board expansion required for the current limit of eight terminals.

For further information contact Hartley Computer Applications Pty Ltd, 80 Jephson St (PO Box 366), Toowong, Qld 4066. (Branches in Sydney, Melbourne, Perth, Brisbane and Adelaide).

## K&L Computing Systems introduces the feature packed Archives Business Computer.

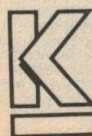
**This highly versatile desk top unit provides high technology at a competitive price.** Suitable for handling all the day by day business requirements, its features include:

- An extremely fast Z80 4MHZ Processor
- CP/M Operating System
- S100 Expansion Bus
- 64K RAM Standard
- 744K Bytes Disk Storage (Expandable)
- 25 Line x 80 col. Display

Available with word processor and complete accounting package, or software can be written to customer's specifications.

Also, see K&L's range of Apple II Plus Computers, floppy disk drives, video monitors, interfaces and expansion options.

- Language card with compilers for Pascal and Fortran
- Z80 Softcard with micro-soft basic compiler and CP/M
- DOS 3.3 upgrade kits (143K Bytes per disk)
- Paper Tiger printer with graphics



**COMPUTING SYSTEMS**

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All Lifeboat programs require CP/M, unless otherwise stated.

*Genuine CP/M for Apple II Available now!*

System	Version Price
Apple II*	2.x 349/25
SoftCard* with Z80	
Microsoft BASIC version 5	
with high resolution graphics	
North Star Single Density	2.x 170/25
North Star Double/Quad	2.x 170/25
Durango F-85	2.x 170/25
ICOM Micro-Disk 2411	1.4 145/25
ICOM 3712 for MITS	
88-25IO Console	1.4 170/25*
ICOM 3712 for	
3P-S/MITS SIO	
Rev non-zero console	1.4 170/25*
ICOM 3812	1.4 170/25*
Mits 3202/Altair 8800	1.4 145/25
Heath H8 - H17	1.4 145/25
Heath H89	1.4 145/25
Ohio Scientific C3	2.x 300/25
Onyx C8001 Standard	2.x 200/25
Onyx C8001 Enhanced	2.x 250/25
TRS-80 Model I	1.4 145/25
TRS-80 Model II	2.x 170/25
TRS-80 Model II - Corvus	2.x 250/25
Processor Technology	
Helios II	1.4 145/25
Intel MDS Single Density	2.x 170/25
Intel MDS Double Density	2.x 170/25
MicroPolis Mod I	2.x 200/25
MicroPolis Mod II	2.x 200/25
Mostek MDX STD	
Bus System	2.x 350/25**

The following configurations are scheduled for release soon:  
 North Star Double/Quad  
 \* Corvus 2.x 250/25  
 Ohio Scientific C3-C 2.x 250/25  
 ICOM 3812 2.x 225/25\*  
 ICOM 4511/Pertec D3000 2.x 375/25\*  
 Software consists of the operating system, text editor, assembler, debugger and other utilities for file management and system maintenance. Complete set of Digital Research's documentation and additional implementation notes included. Systems marked \* and \*\* include firmware on 2708 and 2716. Systems marked + include 5440 media charge. Systems marked @ require the special @ versions of software in this catalog. @ includes hardware addition to allow our standard versions of software to run under it.

**Z80 DEVELOPMENT PACKAGE**—Consists of: (1) disk file editor, with global inter and intra-line facilities; (2) Z80 relocating assembler, Zilog/Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file. **\$95/\$20**  
**ZDT**—Z80 Monitor Debugger to break and examine registers with standard Zilog/Mostek mnemonic disassembly displays. \$35 when ordered with Z80 Development Package. **\$50/\$10**

### AVOCET SYSTEMS

**XASM-68**—Non-macro cross-assembler with nested conditionals and full range of pseudo operations. Assembles from standard Motorola MC68000 mnemonics to Intel hex. **\$200/\$25**  
**XASM-65**—As XASM-68 for MOS Technology MCS-6500 series mnemonics. **\$200/\$25**  
**XASM-48**—As XASM-68 for Intel MCS-48 and UPI-41 families. **\$200/\$25**  
**XASM-18**—As XASM-68 for RCA 1802. **\$200/\$25**

**DISTEL**—Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files. Intel or TDL/Xitan pseudo ops optional. Runs on 8080. **\$65/\$10**

**DISLOG**—As DISTEL to Zilog/Mostek mnemonic files. **\$65/\$10**

**SMAL/80** Structured Macro Assembler  
 Language—Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs. **\$75/\$15**

### PHOENIX SOFTWARE ASSOCIATES

**PASM\***—Z80 macro assembler, Intel/TDL mnemonics. Generates Intel hex format or relocatable code in either TDL Object Module format or PSA Relocatable Binary Module format. Supports text insertion, conditional branching within macros, recursive macro calls and parameter passing. **\$129/\$25**

**EDIT**—Character oriented text file editor. Includes macro definition capabilities. Handles insertion, deletion, searching, block move, etc. for files of any length. Does not require a CRT. **\$129/\$25**

**PLINK\***—Two pass disk-to-disk linkage editor/loader which can produce re-entrant, ROMable code. Can link programs that are larger than available memory for execution targeted on another machine. Full library capabilities. Input can be PSA Relocatable Binary Module, TDL Object Module or Microsoft REL files. Output can be a COM file, Intel hex file, TDL Object Module or PSA Relocatable file. **\$129/\$25**

**BUG\*** and **µBUG\***—Z80 interactive machine level debugging tools for program development. BUG has full symbolic trace and interactive assembly (mnemonics compatible with PASM). Dynamic breakpoints and conditional traps while tracing (even through ROM). µBUG is a subset of BUG and is used in memory limited situations. **\$129/\$25**

### DIGITAL RESEARCH

**MP/M**—Installed for single density MDS-800 Multi-processing derivative of the CP/M operating system. Manual includes CP/M2 documentation. **\$300/\$50**

**MAC**—8080 Macro assembler. Full Intel macro definitions. Pseudo Ops include RPL, IRP, REPT, TITLE, PAGE, and MACLIB. Produces absolute hex output plus symbol table file for use by SID and ZSID (see below). **\$120/\$15**

**SID**—8080 Symbolic debugger. Full trace, pass count and breakpoint program testing. Has backtrace and histogram utilities. When used with MAC, provides full symbolic display of memory labels and equated values. **\$105/\$15**

**ZSID**—Z80 Symbolic debugger with all features of SID. **\$130/\$15**

**TEX**—Text output formatter to create paginated, page-numbered and justified copy. Output can be directed to printer or disk. **\$105/\$15**

**DESPOOL**—Utility program to permit simultaneous printing from text files while executing other programs. **\$80/\$10**

**tiny C**—Interactive interpretive system for teaching structured programming techniques. Manual includes full source listings. **\$105/\$50**

**BDS C COMPILER**—Supports structures, unions, 2 dimensional arrays, pointers, recursion and overlays. Features optimized code generator, variable sized buffers for file I/O, and capability to produce ROMable code. Includes macro package to enable user to produce linkable modules with MAC (see under Digital Research). Floating point functions, full run-time package and machine code library sources provided. Linker, library manager and textbook included. Compiler lacks initializers, statics, floats and longs. **\$145/\$25**

**WHITESMITHS C COMPILER**—The ultimate in systems software tools. Produces faster code than a pseudo-code Pascal with more extensive facilities. Conforms to the full UNIX Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Linkable to Microsoft REL files. Requires 60K CP/M. **\$630/\$30**

### MICROSOFT

**BASIC-80**—Disk Extended BASIC. ANSI compatible with long variable names. WHILE/WEND chaining, variable length file records. MBASIC version 4.51 also included on disk. **\$325/\$25**

**BASIC COMPILER**—Language compatible with BASIC-80 and 3-10 times faster execution. Produces standard Microsoft relocatable binary output. Includes MACRO-80. Also linkable to FORTRAN-80 or COBOL-80 code modules. **\$350/\$25**

**FORTAN-80**—ANSI 66 (except for COM-PLEX) plus many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes MACRO-80 (see below). **\$425/\$25**

**COBOL-80**—Level 1 ANSI 74 standard plus most of Level 2. Full sequential, relative, and indexed file support with variable file names. Powerful interactive, formatted screen handling with ACCEPT and DISPLAY verbs. Program segmentation for execution of programs larger than memory and CHAIN command with parameter passing. Full support of CP/M version 2 files. Includes MACRO-80 (see above), linking loader, and relocatable library manager. Requires 48K CP/M. **\$700/\$25**

**MACRO-80**—8080/Z80 Macro Assembler. Intel and Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included. **\$149/\$15**

**XMACRO-86**—8086 cross assembler. All Macro and utility features of MACRO-80 package. Mnemonics slightly modified from Intel ASM86. Compatibility data sheet available. **\$275/\$25**

**EDIT-80**—Very fast random access text editor for text with or without line numbers. Global and intra-line commands supported. File compare utility included. **\$89/\$15**

**PASCAL/M\***—Compiles enhanced Standard Pascal to compressed efficient Pcode. Totally CP/M compatible. Random access files. Both 16 and 32-bit integers. Runtime error recovery. Convenient STRINGS. OTHERWISE clause on CASE. Comprehensive manual (90 pp. indexed). SEGMENT provides overlay structure. IMPORT/EXPORT and untyped files for arbitrary I/O. Requires 56K CP/M. Specify 1) 8080 CP/M, 2) Z80 CP/M, or 3) Cromemco CDOS. **\$175/\$20**

**PASCAL/Z**—Z80 native code PASCAL compiler. Produces optimized, ROMable re-entrant code. All interfacing to CP/M is through the support library. The package includes compiler, relocating assembler and linker, and source for all library modules. Variant records, strings and direct I/O are supported. Requires 56K CP/M. **\$395/\$25**

**PASCAL/MT**—Subset of standard PASCAL. Generates ROMable 8080 machine code. Symbolic debugger included. Supports interrupt procedures. CP/M file I/O and assembly language interface. Real variables can be BCD, software floating point, or AMD 9511 hardware floating point. Includes strings enumerations and record data types. Manual explains BASIC-PASCAL conversion. Requires 32K. **\$250/\$30**

**APL/V80**—Concise and powerful language for application software development. Complex programming problems are reduced to simple expressions in APL. Features include up to 27K active workspace, shared variables, arrays of up to 8 dimensions, disk workspace and copy object library. The system also supports auxiliary processors for interfacing I/O ports. Requires 48K CP/M and serial APL printing terminal or CRT. **\$500/\$30**

**ALGOL-60**—Powerful block-structured language compiler featuring economical run-time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling direct disk address I/O etc. **\$199/\$20**

**CBASIC-2** Disk Extended BASIC—Non-interactive BASIC with pseudo-code compiler and run-time interpreter. Supports full file control, chaining, integer and extended precision variables, etc. Versions of CRUN for CP/M versions 1.4 and 2.x included on disk. **\$120/\$15**

### MICRO FOCUS

**STANDARD CIS COBOL**—ANSI 74 COBOL standard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full ISAM file facility. Also, program segmentation, interactive debug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal. **\$850/\$50**

**FORMS 2**—CRT screen editor. Output is COBOL data descriptions for copying into CIS COBOL programs. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. No programming experience needed. Output program directly compiled by STANDARD CIS COBOL. **\$200/\$20**

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### EIDOS SYSTEMS

**KBASIC**—Microsoft Disk Extended BASIC version 4.51 integrated with KISS Multi-Keyed Index Sequential and Direct Access file management as 9 additional BASIC commands. KISS included as relocatable modules linkable to FORTRAN-80, COBOL-80, and BASIC COMPILER. Specify CP/M version 1.4 or 2.x when ordering. Requires 48K CP/M. **\$585/\$45**  
 To licensed users of Microsoft BASIC-80 (MBASIC) **\$435/\$45**

**XYBASIC** Interactive Process Control BASIC—Full disk BASIC features plus unique commands to handle byte rotate and shift and to test and set bits. Available in several versions:  
 Integer ROM squared **\$350/\$25**  
 Integer CP/M **\$350/\$25**  
 Extended ROM squared **\$450/\$25**  
 Extended CP/M **\$450/\$25**  
 Extended Disk CP/M **\$550/\$25**  
 Integer CP/M Run Time Compiler **\$350/\$25**  
 Extended CP/M Run Time Compiler **\$450/\$25**

**RECLAIM**—A utility to validate media under CP/M. Program tests a diskette or hard disk surface for errors, reserving the imperfections in invisible files, and permitting continued usage of the remainder. Essential for any hard disk. Requires CP/M version 2. **\$80/\$5**

**BASIC UTILITY DISK**—Consists of: (1) CRUNCH-14—Compacting utility to reduce the size and increase the speed of programs in Microsoft BASIC 4.51, BASIC-80 and TRS-80 BASIC. (2) DPUN—Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sine, arc sine, hyperbolic sine, hyperbolic arc sine, etc. Furnished in source on diskette and documentation. **\$50/\$35**

**STRING-80**—Character string handling plus routines for direct CP/M BIOS calls from FORTRAN and other compatible Microsoft languages. The utility library contains routines that enable programs to chain to a COM file, retrieve command line parameters and search file directories with full wild card facilities. Supplied as linkable modules in Microsoft format. **\$95/\$20**  
**STRING/80** source code available separately—**\$295/NA**

**THE STRING BIT**—FORTRAN character string handling. Routines to find, fill, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source. **\$65/\$15**

**VSORT**—Versatile sort/merge system for fixed length records with fixed or variable length fields. VSORT can be used as a stand-alone package or loaded and called as a subroutine from CBASIC-2. When used as a subroutine, VSORT maximizes the use of buffer space by saving the TPA on disk and restoring it on completion of sorting. Records may be up to 255 bytes long with a maximum of 5 fields. Upper/lower case translation and numeric fields supported. **\$175/\$20**

**CPM/374X**—Has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files. **\$195/\$10**

### CPAids\*

**MASTER TAX**—Professional tax preparation program. Prepares schedules A, B, C, D, E, F, G, H, R, P, SE, TC, ES and forms 2106, 2119, 2210, 3468, 3903, 2441, 4625, 4726, 4797, 4972, 5695 and 6251. Printing can be on readily available, pre-printed continuous forms, on overlays, or on computer generated, IRS approved forms. Maintains client history files and is interactive with CPAids GENERAL LEDGER II (see below). **\$995/\$30**  
 Annual Update Fee **\$350**

**STANDARD TAX**—As above for schedules A, B, C, D, E, G, H, R, P, SE, TC and forms 2106 and 2441. Also, does not maintain client history files. **\$495/\$30**  
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	BDS C, tiny C, and Whitesmiths C users	\$12
<input type="checkbox"/>	<b>STRUCTURED MICROPROCESSOR PROGRAMMING</b> —By the authors of <i>SMAL/80</i> . Covers structured programming, the 8080/8085 instruction set and the <i>SMAL/80</i> language	\$20
<input type="checkbox"/>	<b>ACCOUNTS PAYABLE &amp; ACCOUNTS RECEIVABLE—CBASIC</b> —By Osborne/McGraw-Hill	\$20
<input type="checkbox"/>	<b>GENERAL LEDGER—CBASIC</b> —By Osborne/McGraw-Hill	\$20
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vice, Inc.  
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ness Application, Inc.  
Peachtree Software is a trademark of Retai-  
Sciences, Inc.

† Recommended system configuration consists of 48K CP/M, 2 full size disk drives, 24 x 80 CR and 132 column printer.

Ⓜ Modified version available for use with CP/M as implemented on Heath and TRS-80 Model computers.

④ User license agreement for this product must be signed and returned to Lifeboat Associates before shipment may be made.

⑤ Serial number of CP/M system must be

② Requires Z80 CPU.

---

**ST.** Diskette, cartridge disk and cartridge tape were for listed computer or disk systems. All

Format Code	Computer system	Format Code
348	IBM S/360, S/370	BF

Cartridge		RAIH Double Density	RE
	D1 #	Research Machines 8	A1
Cartridge		Research Machines 5 1/4	RH
	D2 #	REX	Q3
	RA	Sanco 7000 5 1/4	RQ

A1*	SD Systems 8	A1*
R4**	SD Systems 5 <sup>1</sup> <sub>4</sub>	R3
R4**	Sorcerer	See Exidy Sorcerer
R5*	Spacebyte	A1
A1**	SuperBrain	See Intertec

See ISC Intecolor	A1	Superman	A1*
Density	A2	Tarbell	R3
e Density	A5	TEI 5 1/4	A1*
ain DOS 0.1	R7	TEI 8	
		Thinkertoys	See Morrow Discus
		TOP 80 M-dell 5 1/4	R1

ain DOS 0.5-2 X	RJ	TRS-80 Model I 5'	A2
ain DOS 3 X	RK	TRS-80 Model I - FEC Freedom	RN
63/8360/8963	A1	TRS-80 Model I - Micromation	A4
	RF	TRS-80 Model I - Omikron 51a	RM
	P6	TRS-80 Model I - Omikron 8	A1

30 below)	A1*	TRS-80 Model I - Shuffleboard 8	A1
	Q1	TRS-80 Model II	A1
	Q2	VDP-40/42/44/80	See IMSAI
	Q2	Vector Graphic	Q2
	Q2	Vector MZ	Q2

B1	Versatile	See CDS Versatile
A1*	Vista V80 5 <sup>1/4</sup>	Single Density P5
A1	Vista V200 5 <sup>1/4</sup>	Double Density P6
RC	Zenith Z89	Lifeboat CP/M P4
e Density	Zenith Z89	Magnolia CP/M P7

.../Quad	P2	Zenith 205	Magnum 3
nsity	Q3		
s Mod. II	Q2		
C3	A3		
	T2 #		

00  
Technology Helios II  
nsity

A1\*  
B2  
RO  
RP  
R9

**C R**

Single-Density disks  
for use with Double-  
Double-Side 8 soft  
systems

charge of \$25 for or-  
ormats T1 and T2 and

**54 POWER ST  
HAWTHORN 3122  
03 8192411**

**TELEX AA38466**

ustralia, December, 1980 14

\*CP/M and MP/M are trademarks of Digital Re-

☐ **HEAD CLEANING DISKETTE**—Cleans the drive Read/Write head in 30 seconds. Diskette.

Single sided .....	\$20 each/\$55 for
Double sided .....	\$25 each/\$65 for

☐ **FLOPPY SAVER**—Protection for center hole

5" Kit	\$14.95
5" Rings only	\$7.95
8" Kit	\$16.95

Pascal/Z, Pascal/M and Pascal/MT users \$5

### Ordering Information

**MEDIA FORMAT ORDERING CODES**

When ordering, please specify format code

**LIFEBOAT ASSOCIATES MEDIA FORMATS LIST.** Diskette, cartridge disk and cartridge tape format codes to be specified when ordering software for listed computer or disk systems. All software products have specific requirements in terms of hardware or software support, such as MPU type, memory size, support operating system or language.

Computer system	Format Code	Computer system	Format Code	Computer system	Format Code
Altair 8800 Disk	See MITS 3200	iCOM 4511 5440 Cartridge		RAIR Double Density	RE
Altos	A1*	CP/M 1.4	D1 #	Research Machines 8	R1
Apple - SoftCard 13 Sector	RG	iCOM 4511 5440 Cartridge		Research Machines 5 1/4	C3
Apple - SoftCard 16 Sector	RR	CP/M 2.2	D2	REX	C3
AVL Eagle	RB	IMS 5000	RA*	Sanco 7000 5 1/4	R1*
BASF System 7100	RD	IMS 8000	A1*	SD Systems 8	A0
Blackhawk Single Density	C3	IMSAI VDP-40	R4**	SD Systems 5 1/4	R3
CSN Blackhawk Mod II	Q2	IMSAI VDP-42	R4**	Sorcerer	See Exidy Sorcerer
CDS Versatile 3B	Q1	IMSAI VDP-44	R5**	Spacebyte	A1
CDS Versatile 4	Q2	IMSAI VDP-80	A1**	SuperBrain	See Intertec
COMPAL-80	Q2	Intecolor	See ISC Intecolor	Tarbell	A1*
Cromemco System 3	A1*	Intel MDS Single Density	A2	TEI 5 1/4	R3
Cromemco 22D	R6	Intel MDS Double Density	A5	TEI 8	A1*
CSN BACKUP (tape)	T #	Intersec SuperBrain DOS 0.1	R7	Thinktoys	See Morrow Discus
Delta	T #	Intersec SuperBrain DOS 0.2-5 X	RJ	TRS-80 Model I 5 1/4	R2
DiG-Log Microterm II	RD	Intersec SuperBrain DOS 3 X	RK	TRS-80 Model I - FEC Freedom	RN
Digital Microsystems	A1*	ISC Intecolor 8063/8360/8963	RI	TRS-80 Model I - Mikromotion	A4*
Discus	See Morrow Discus	Kontroln PSI-80	RF	TRS-80 Model I - Omikron 8	A1
Durango F-85	RL	Meca 5 1/4	PG	TRS-80 Model I - Shuffleboard 8	A1*
Dynabyte DB8/2	R1	Micromotion		TRS-80 Model I - VDP Model II	A1*
Dynabyte DB8/4	A1*	(Except TRS-80 below)	A1*	TRS-80 Model I - Mikromotion	A4*
Exidy Sorcerer - Lifeboat CP/M	Q2	Microdisks Mod I	Q1	TRS-80 Model I - OMKron 5 1/4	RM
Exidy Sorcerer - Exidy CP/M	Q4	Microdisks Mod II	Q2	Vector Graphic	Q2
Heath H89 - H17/H27	P4	MITS 3200/3202	B1	Vector M2	Q2
Heath H89 - Lifeboat CP/M	P4	Morrow Discus	A1*	Versatile	See CDS Versatile
Heath H89 - Magnolia CP/M	P7	Mostek	A1	Vista V80 5 1/4 Single Density	P5
Helios II - See Processor Technology		MSD 5 1/4	RC	Vista V200 5 1/4 Double Density	P6
Helios II - See Processor Technology		North Star Single Density	P1	Zenith 289 - Lifeboat CP/M	P4
iCOM 2411 Micro Floppy	R3	North Star Double/Quad	P2	Zenith 289 - Magnolia CP/M	P7
iCOM 3712	A1*	Nylac Single Density	Q3		
iCOM 3812	A1*	Nylac Microdisks Mod II	Q2		
		Ohio Scientific C3	A3		
		Onyx C8001	T2*		
Prices reflect distribution on 8		Peritek PCC 2000	A1*		
single density diskettes. If a		Processor Technology Helios II	B2		
format is requested which		Quay 500	R0		
requires additional diskettes,		Quay 520	R9		
a surcharge of \$8. per additional		RAIR Single Density	RP		
diskette will be added.					

Prices F.O.B.  
Shipping, handling and C.O.D.  
charges extra.

Manual cost applicable against price of subsequent software purchase.

The sale of each proprietary software package conveys a license for use on one system only.

ject to change in the case of unusual circumstances. The formal equipment

- \* Single-Side Single-Density disks are supplied for use with Double-Density and Double-Side 8" soft-secter format systems.

\*\* IMSAI formats are single density with directory offset of zero

# A media surcharge of \$25 for orders on tape formats T1 and T2 and of \$100 for orders on disk formats D1 and D2 will be added.

The list of available formats is subject to change without notice. In case of uncertainty, call to confirm.

the format code for any particular equipment

54 POWER ST  
HAWTHORN 312  
03 8192411  
TELEX AA38466



# PASCAL AND VISICALC TOO!

Now Commodore Micro-Computers enable you to make use of these advanced software features.

**PASCAL** Commodore's disk based PASCAL is the full UCBD version with extra features to make use of Commodore's unique hardware facilities.

**VISICALC** This popular package is suitable for a wide range of uses including sales projections, financial modelling and statistical analysis. By treating the VDU as a "window" into an "electronic work sheet" with 254 rows and 63 columns any part of the sheet can be scanned by using the cursor controls. Numbers, labels and formulae can be easily inserted and complex operations on them defined.

Both PASCAL and VISICALC require a Commodore 3032 or 8032 Micro-Computer, 3040 disk drive and 3022 printer.

## COMPUTER BOOKS

MICROCOMP are now selling a wide range of books and magazines on all facets of computers and computing. Drop in or write to us for our complete catalogue. (Please enclose 28c stamp for postage). If you are having difficulty in getting hold of a particular publication, we may be able to help.



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561 Bourke Street,  
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**Tel: 614-1433/614-1551**

## ANNOUNCING...

**GODBOUT ECONORAM XX** 32K of static RAM reliability at near dynamic prices.

- IEEE S100 with extended addressing and bank select.
- 4MHz operation • fully socketed.
- Available with 16K, 24K, or 32K of RAMS.
- "UNKIT" or ASSEMBLED-UNKIT has sockets, caps & dip switches pre-installed.

*PRICES (excluding sales tax).*

With 16K of RAM.

UNKIT: \$334.95 ... \$319.00 \*  
.... Assembled \$418.95 ... \$399.00 \*

With 24K of RAM.

UNKIT: \$450.45 ... \$429.00 \*  
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With 32K of RAM.

UNKIT \$586.95 ... \$559.00 \*  
.... Assembled \$733.95 ... \$699.00 \*

*\* Introductory offer for December.*

We are S100 specialists - see us for GODBOUT, MORROW, SSM, BASE2, EXIDY, and just about everybody else.

**COMPUPRO™ from GODBOUT AND**



ACOUSTIC ELECTRONIC DEVELOPMENTS PTY LTD

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130 Military Road, Guildford,  
NSW 2161. Phone (02) 632-6301,  
(02) 632-4966. Telex AA25958.

**Trading hours Mon-Sat  
9AM to 6PM.**

***Prices and specs subject to change without prior notice.***



## Microcomputer News & Products

### Synertek now available from Royel Micro

A versatile, dedicated microcomputer development system, identified as Synertek System 65, is now available in Australia through Royel Micro Systems.

This powerful and complete development system for the SY6500 family of computers requires only the addition of a user supplied TTY or RS232-compatible terminal. The system contains a Text Editor, Two-Pass Assembler and Dynamic Debug Package supplied in ROM for maximum system reliability.

One outstanding feature of this system is that the mass storage devices are built into the basic console. Each built-in drive provides storage capacity for 78K bytes

of source statements or object code.

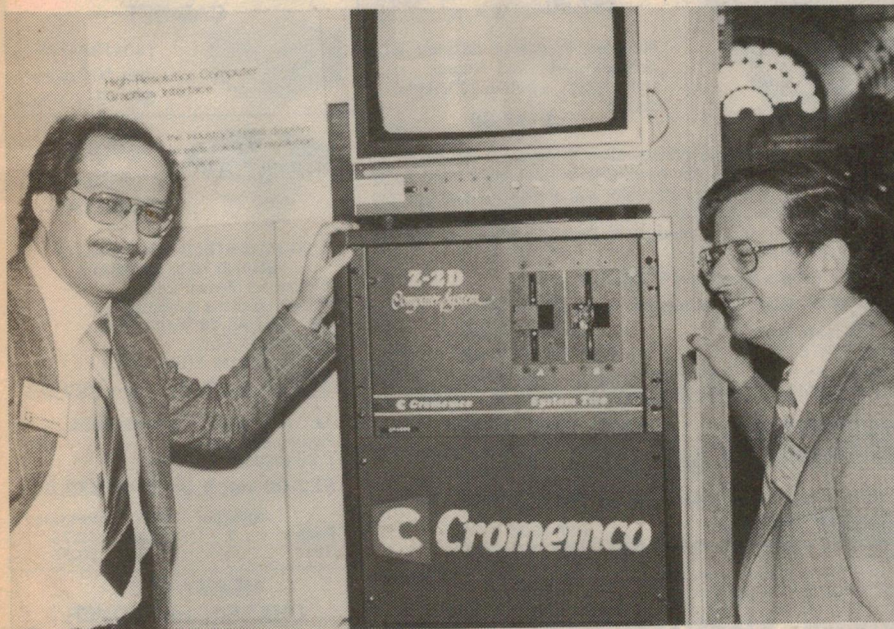
System 65 is supplied with a front mounted zero-insertion-force socket which holds 2708 or 2716 EPROM chips. When used with the PROM programming hardware/software option, it allows the user to easily copy object code from RAM to PROM.

The basic hardware comprises:

- Two system CPU boards with processor, bus drivers, timing logic, system software ROM and RAM;
- I/O board for parallel and floppy disk control;
- 16K RAM board;
- Internal power supply;
- Front panel with power-on indicator, reset switch, single step switch, PROM programming socket and two mini-floppy disk drives;
- Rear panel RS232, 20mA current loop and Centronics-compatible printer and scope synch connectors; power switch.

Enquiries should be directed to Royel Micro Systems, 27 Normanby Rd, Notting Hill, Vic 3168; or 15/59 Moxon Rd, Punchbowl, NSW 2196.

### Cromemco introduces high resolution Computer Graphics Interface



Cromemco has announced the release of a high resolution graphics system designed to operate in CP/M compatible, S100 bus environment. Offering resolution up to 754 x 482 points, it features a unique, patented method of colour selection.

This board has many other useful features including dual page windowing, animation facility, automatic area fill mode and digitiser pad input — all fully supported by software.

A complete Winchester drive based computer featuring these products is available as the Z2H/GS for \$14,500, whilst the boards themselves are available for \$600. Pictured above is part of a comprehensive display of this equipment which was shown at the 8th World Computer Conference.

Local Cromemco agents are Informative Systems Pty Ltd, 3 Bank St, South Melbourne, Victoria 3205. Telephone (03) 690 2284.

## \$ THE LOGIC

SHOP PTY. LTD.

### First Birthday Sale. Special Discounts offered on all stock

#### COMPUCOLOR II

Ex  
Stock



features:

Up to 32K User RAM  
Eight-colour display  
32 lines of 64 char.  
5" Mini Disk Drive  
40 Tracks, 48 TPI

#### TELEVIDEO TVI-912

Ex  
Stock



features:

24 lines  
80 char. per line  
Transmission rates 75-19,200 Bd.  
96 char. ASCII Upper & Lower Case  
12" Monitor

#### MICROLINE 80 PRINTER

Ex  
Stock



features:

80 char. per sec.  
80 and 132 char. per line  
9x7 DOT MATRIX character or  
graphics printing.

#### PLUG COMPATIBLE TO TRS-80

(TRS-80 is a regd. trade name of  
The Tandy Corp.).

**SPECIAL**

**5 1/4 DISKETTS**

**\$3.95 EACH (INC. TAX)**

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BARGAIN PRICES • PERSONAL ATTENTION • SLICK MAIL ORDER SERVICE • SATISFACTION

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IDEAL FOR — AMPS • POWER  
SUPPLIES • TRANSMITTERS,  
ETC.

GUARANTEED GOOD WORKING  
ORDER. IMP. PROTECTED

220vac 50/60Hz  
120x120x38mm **\$17.50**  
115vac 50/60Hz  
120x120x38mm **\$15.50**  
115vac 50/60Hz  
80x80x38mm **\$12.50**  
P-P NSW \$1.50. Interstate \$2.50.

## ! COOL IT !

### CEILING FAN MOTOR

**\$14.50**

200-240VAC 50Hz,  
3 types.

75 watt for 36" blades  
75 watt for 48" blades  
90 watt for 56" blades

**SPEED CONTROLLER  
INCLUDED**

P-P NSW \$4.50. V, SA, T, Q, \$6.50.  
WA, NT, \$7.50.



### 1/2 PRICE CALCULATOR PLUG PACK

240V AC 50Hz. Double insulated.  
3VDC 300mA with plug and cable.  
Approved.

**\$3.50** P-P \$1.50.

### • DISCOUNT PRICES • CANNON AUDIO CONNECTORS

	EA	10UP
XLP-3-11- C Female plug 3 pin	\$3.25	\$2.70
XLP-3-12- C Male plug 3 pin	\$2.30	\$1.90
XLP-3-31 Female panel MT socket 3 pin	\$3.85	\$3.25
XLP-3-32 Male panel MT socket 3 pin	\$1.80	\$1.58

Full range at low prices available.  
ADD pack and post for each 75c  
10 up P-P NSW \$2.50. Interstate  
\$3.50.

### • GREAT XMAS GIFT • ULTRA LIGHTWEIGHT STEREO HEADPHONES

PROFESSIONAL SERIES  
REDUCED  
FROM  
**\$27**



DEC. ONLY  
**\$22.95**  
LIMITED STOCK  
PP NSW \$1.50  
INTERSTATE \$2.50

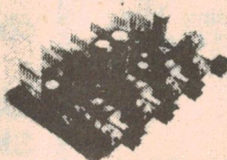
Ultra thin high velocity mylar  
diaphragms for new level of sound.  
Comfort assured. Wt 5oz, quality of  
reproduction guaranteed.  
Adjustable headband with plug, cable,  
freq. 20-22000Hz. 4-16 ohms, .3W.

DELUXE MODEL — with separate vol.  
controls, mono/stereo switch. Padded  
ear cushions, plug and cable, freq.  
20-20000Hz, .5W, 4-16 ohms.

**\$13.50** P-P NSW \$1.50.  
INTERSTATE \$2.50

Patch cable with 6.5mm stereo plug,  
3m cable to 2 separate 6.5mm inline  
stereo sockets, \$3.50.

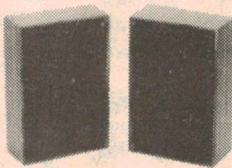
### 20 WATT STEREO AMPLIFIER CHASSIS



• XMAS SPECIAL •  
240V 50Hz • Power transformer included •  
Circuit • Easy to install • Specs • Output 8-16  
ohms • 10 watts RMS per ch • Distortion 0.5%  
• Freq response 35-18000Hz • Input sen  
500MV • Bass, treble, balance, volume controls

**\$39.95.** PP \$3.00. Interstate \$4.50  
REFER TO AUG 79 EA FOR GREAT REVIEW

### FACTORY SCOOP • 1/2 PRICE BARGAIN • BRAND NEW A1 QUALITY • 8"(20cm) 2-WAY SPEAKER SYSTEM • 8 OHMS • 10 WATTS •



**\$42 PAIR**

ATTRACTIVE WALNUT CABINET:  
52H x 30W x 14 1/2 D cm

P&P NSW \$3.00. SA, V, Q \$4.00  
TAS, NT, WA \$5.50



WORLD'S LARGEST MANUFACTURER  
RECORD CHANGERS/PLAYERS

MODEL  
P-208

### BELT DRIVE STEREO PLAYER



Mechanism, cartridge only.

Pack and post NSW. \$4.50. V. SA.  
T. Q. \$5.50.  
W.A. NT. \$6.50.

**\$87.50**

Mounted in walnut cabinet, with  
perspex dust cover, hinges.  
P-P NSW \$6.50 INTERSTATE  
\$8.50.

**\$117.50**

Specs. 240VAC 50Hz, auto or manual operation • Plays 17, 25, 30cm (7,  
10, 12in) records • 33 and 45 rpm, adjustable counter weight and stylus  
pressure • cueing lever • Bias compensator and anti skate control • Big  
platter with mat • RCA audio plugs and cable, 3-core power cable and plug  
• High quality ADC magnetic cartridge • Diamond Stylus • Cut-out  
Template, instruction book •

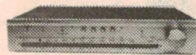
Pro Model P-200. (specs. as above) **\$105.00**

or mounted in walnut cabinet with perspex cover **\$137.50**

P-P NSW \$4.50  
INTERSTATE \$6.00

P-P NSW \$6.50  
INTERSTATE \$8.50

### • SLIM LINE LOW PROFILE AM-FM STEREO TUNER •



400W x 76H x 280D mm

P&P NSW \$3.50  
**\$149.95** INTERSTATE \$5.50

### 20 + 20W RMS STEREO AMPLIFIER TO MATCH



P&P NSW \$3.50  
**\$149.95** INTERSTATE \$5.50

Top quality and performance guaranteed. 12 month parts and labour  
warranty. Send SAE for full technical data.

### ATTENTION!! STEREO FM TUNER BUILDERS

Fully constructed front end tuner complete with coils • Variable tuning con-  
denser, 3:1 gear ratio, 2 gang AM, 3 gang FM • High freq amp with 2 RF  
stages • 3 transistors FET input varactor diode (AFC) • Reception band  
87.5-108.5MHz • IF freq 10.7MHz • Input imp 300 ohms • Supply 12V  
at 10mA • In fully shielded metal box 74W x 70D x 42H mm • Circuit in-  
cluded • Top quality unit guaranteed •

**\$19.95**

P&P NSW \$1.50. INTERSTATE \$2.00

### • VARICAP VHF FRONT END TUNER •

2 Bands, 46.25 — 107.75MHz. 1F freq. 33.4MHz and 138.25 —  
221.75MHz. 1F freq. 38.9MHz. Imp. 75 ohms. 3 transistors, 10 diodes,  
PCB in fully shielded box. 90x88x20mm. Operating voltage, 0.3 — 28V,  
tech data, circuit included.

**\$19.95** P-P \$1.50

### DOUBLE C-CORE TRANSFORMER

Primary 240V AC 50Hz  
Sec 0-18V 12.5 amp cont. 30 amp  
peak.

**\$49.95.**

P-P NSW \$4.50. V, SA, Q, T, \$6.  
WA, NT, \$7.50.

### MOTOROLA TOP GRADE 2N3055 TRANSISTORS

P-P NSW \$1.50  
10 for **\$7.75** INTERSTATE \$2.50

Mounting kit for above. Includes,  
nuts, bolts, washers, bushes, mica  
insulator. Hardware is chrome plated  
brass.

10 Kits for **\$2.50** P-P 75c.

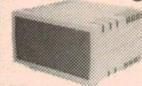
### 12 VOLT 1 1/2 AMP BATTERY CHARGER KIT

Kit includes, Aust made Transformer,  
240VAC 50Hz, Silicon Bridge  
Rectifier, LED, Switch, Cables,  
Power Plug, Screw Terminal Strip.  
Instructions.

P-P NSW \$2.50  
**\$11.95** INTERSTATE \$3.50

*And for a really professional  
finish, install the charger in the*

### VENTILATED, HI-IMPACT PLASTIC INSTRUMENT CABINET



140x130x78mm  
(has 101 uses)  
**\$5.35** P-P 80c



ETONE  
12" SPEAKER  
SPECIAL

### GUARANTEED TOP QUALITY BRAND NEW BARGAIN

\* Rugged diecast frame.  
8 and 15 ohms available.  
12" Woofer, 30 Watts RMS.  
Resonance 65Hz.  
Freq response 50-8000Hz

**\$21.00 each or 2 for \$37.95**

12" Twin Cone, 30 Watts RMS.  
Resonance 65Hz.  
Freq respon 50-15kHz.

**\$22.00 each or 2 for \$39.95**

	Speaker	NSW	Interstate
Pack	1	\$2.00	\$2.75
Post	2	\$2.75	\$3.75

### HEAVY DUTY CHASSIS and COVER

• Can be 19" rack mounted  
• Fully ventilated  
• Top quality ex-PMG  
485W x 155D x 120H mm.  
P-P NSW \$3.50  
Interstate \$5.50

**\$7.50**

### • HEAT SINK •

• Double sided Cooling Fins  
• A1 quality. Ex-PMG.  
• 134x110x58mm. For to 3, etc.

### SERVICE

Moderate charges — Repairs  
guaranteed. Radios, Tape  
Recorders, Cassettes, Amps.



## Microcomputer News & Products

### Computer Line Conditioners from Ferguson Transformers

Pictured at right is one of a range of four Computer Line Conditioners recently released by Ferguson Transformers Pty Ltd. The Conditioners use ferro-resonant transformers to hold the output voltage to within typically  $\pm 3\%$  for input voltage variations of as high as  $\pm 15\%$ . In addition, the sinusoidal output has typically less than 3% harmonic content, regardless of mains voltage distortions.

A time-delay relay is incorporated to protect the computer from switch-on transients. As well, both transverse and common-mode noise are heavily attenuated by the use of magnetically separate windings of the ferro-resonant transformers. In addition, the transformers are inherently short-circuit proof and may be run continuously in this condition without damage.

Consequently, a computer will not lose memory contents due to low voltage or momentary loss of supply. At the same time, the computer will be protected from damaging high voltage transients which can often occur on the mains supply.

The four models are suitable for connection to a 240V 50Hz mains supply and have nominal ratings of 250, 500, 1000 and 2000VA. In addition, Ferguson have a range of transformers for constant voltage applications with ratings from 150VA to 2kVA. Special design work can also be carried out to customer requirements.



## Synertek

A Honeywell Company

### TICK ITEMS OF INTEREST

- ☐ Static RAMS
- ☐ EPROMS
- ☐ Custom ROMS
- ☐ SYM-1 Single Board Computer
- ☐ Keyboard terminals, KTM-2 & KTM-2/80
- ☐ 8K BAS-1 & 8K RAE-1 Resident Assembler Editor for SYM-1 ROM Resident
- ☐  $\mu$ P Computer Module, Super-Jolt
- ☐ 6500 Micro's & peripheral IC's
- ☐ Low cost/low quantity custom LSI's
- ☐ Industrial systems engineering

Please send information on items ticked. My application is:

- ☐ HOBBY
- ☐ INDUSTRIAL
- ☐ PROFESSIONAL

Name: .....

Company: .....

Address: .....

Post Code: ..... Phone: .....



### ROYAL MICRO SYSTEMS PTY. LTD.

VIC: 27 Normanby Rd., Notting Hill, 3149. Phone 543 5122

NSW: 15/59 Moxon Rd., Punchbowl, 2196. Phone 709 5293

SRC100A

## COMP-SOFT MICROCOMPUTER SERVICES

**FREE**

**\$50 WORTH OF SOFTWARE WITH EVERY OSI COMPUTER**

Superboard (4K RAM, 10K ROM, 24 x 32, VDU, RS232)

C1P (Superboard - Case - Power Supply)

C4P (8K, RAM, 10K ROM, 64 x 32 VDU, RS232)

C4P MF (24K RAM, 64 x 32 VDU, Mini floppy)

C8P DF (32K RAM, 64 x 32 VDU, Dual 8" - floppies)

\* excluding tax

### C30 CASSETTES only:

1 - 10 99c each

10 - 50 89c each

50 - 79c each

**235 SWAN STREET, RICHMOND, 3121. PHONE: (03) 428 5269**

### TV/MONITORS

Black & White \$129.00\*

Colour \$429.00\*

\* including tax

Suitable for most computers.



### MICROLINE 80 PRINTER

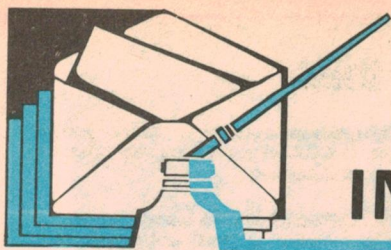
- 80 Char/sec
- 80 and 132 Char/line
- 9 x 7 dot matrix
- character or graphics printing

### CIP EPROM MONITORS

Cursor control, single key basic etc

\$49 incl. tax





## INFORMATION CENTRE

**GATE CONTROL:** I am regular reader of "Electronics Australia". At our house we have two iron gates which open outwards. Could you suggest a way of motorising these gates, similar to the roller door idea? I am sure other readers are in the same position of opening gates to drive their cars in. (J.K.C., Moana South, SA).

● While we have produced suitable electronics to suit a garage door or gate controller, you will have to solve the mechanical problems yourself. Once you have a suitable mechanism, the job is easy. The two articles we refer you to: "Remote power control receiver", October 1970, 2/MC/6 and "remote power control transmitter", November 1970, 2/MC/7.

**CAPACITANCE METER:** I have recently built the Digital Capacitance Meter described in the March 1980 issue. I have found it extremely useful, except that it cannot be nulled on the picofarad range.

### Flash exposure meter drift problems

**FLASH EXPOSURE METER:** I have just built your Flash Exposure Meter as described in January, 1980 and I find that I am having some problems with it. When zeroed and left switched on for some length of time the needle slowly creeps below the zero mark. The sample and hold function seems a little "leaky". It peaks to say 8 and within 10 to 15 seconds it slowly drifts downwards, making it very difficult to calibrate. Once "calibrated", using the flash set to manual, it behaves inconsistently with the flash on automatic. After further experimentation, I have noted that the flash duration seems to be the critical factor. When the flash is operating so as to produce shorter flashes, the reference meter reads at least one stop lower than the constructed meter. Should not the meter read quantity of light? This one seems to read intensity. When buying the ICs for this project, I noticed that the assistant was not very careful in handling them. When I questioned this procedure, I was told that the relevant ICs were diode protected. Was he right? (C. K., Thornlands, Qld).

● Before answering your questions C. K., we would like to mention that some cases have come to our notice with the

The 22k $\Omega$  trimpot was replaced with a 20k $\Omega$  and the 150 $\mu$ F tantalum capacitors were replaced with 220 $\mu$ F electrolytics. Could these substitutions have anything to do with the inability to null. (A.M., Arncliffe, NSW).

● The substitutions you have made are quite acceptable. The most probable cause for your meter not being able to be nulled is that the internal wiring capacitance is too high. Note that we have suggested in recent Notes & Errata (November 1980) that only high quality RF cable such as RG58 or colour TV coax be used for the shielded cable.

**PLAYMATE AMPLIFIER:** I have built and to a degree successfully completed the Playmate as described in the January 1980 issue. Although the unit works well, the voltages measured are nowhere near those stated on the circuit diagram (ie, within  $\pm 10\%$ ). As a struggling self-taught electronics bug, I would like to know if you can guide me to getting

the optimum results for my effort. As well as the "out of spec" voltages, I am also having trouble with the balance control, which is difficult to centre; there is either too much left or right channel. (R. G., East St Kilda, Vic).

● We assume that the power supply is delivering somewhere around 24 volts. If the voltage is considerably lower than this, then look for shorts. A low power supply can affect all voltage readings throughout the circuit. With a correct power supply voltage, the speaker active output should be at a voltage halfway between the supply rails, 12 volts in this case. If not, the resistors biasing Q2 should be checked. The balance control works by increasing the gain of Q2 and decreasing that of Q102 or vice versa. Check that your resistors are correct and that the capacitors in series with the balance control are correctly oriented.

**CINEMA SOUND:** I am currently considering the use of two of your projects in a cinema Sensuround system. The projects are the Pink and White Noise Generator described in April, 1978 and the Super Bass Filter described in February, 1978. Does the frequency response of the Pink and White Noise Generator extend to or below 10Hz, as the graph in the article only shows response to 20Hz? What sized capacitors would be required in the Super Bass Filter to provide a cut-off frequency as close as possible to but not below 17Hz? Your assistance in answering these queries would be invaluable. (R. K., Singleton, NSW).

● White noise is characterised by equal energy per bandwidth (that is, there is the same amount of energy between five and 15Hz as there is between 20 and 30Hz). Thus in any white noise there is a 10Hz component, although not shown on the graph accompanying our article because it is below the minimum audible frequency.

It should be noted however that the White and Pink Noise Generator based on the MM5837 IC is not a source of truly random noise. The IC generates noise digitally in the form of a long pseudo-random binary sequence, using a 17 stage shift register with feedback. The pseudo-random sequence repeats itself about every 1.31 seconds, and this repetitive pattern is plainly evident if a narrow range of frequencies are

complaint that the meter drifted. It turned out that the builders used a corrosive soldering paste in addition to the resin-cored solder. When the boards were thoroughly cleaned of paste, the meters functioned properly, with very little drift. On the prototype, the zero would drift about the thickness of the needle in more than a minute. Similarly, the same amount of drift was observed when a reading was taken. We considered that this was adequate, bearing in mind that we were keeping the design as simple as possible, consistent with satisfactory results. If your unit is substantially worse than this, then there may be a faulty component to blame, such as the 1 $\mu$ F storage capacitor, the hot-carrier diode, or the board may be leaky.

With respect to the use of the meter with the flash set on automatic, there is some doubt as to the validity of the meter's use under these conditions. Normally, only the manual setting would need to be used and the meter reading would be taken under these conditions. The shop assistant was right, in that the op. amp. devices are diode protected. All the same, we like to see them protected by one of the approved packing methods when they are purchased.



amplified. Thus, while our noise generator is suitable for wide-band testing of audio equipment (which was the purpose of the design) it is not suitable for use as a source of random noise in the 10Hz region.

For applications requiring random noise at low frequencies, a noise generator based on a reverse-biased diode would be more suitable.

The relationship between the cut-off frequency and the capacitor values of our Super Bass Filter is sufficiently linear to allow new values to be calculated by a simple proportional method. To achieve a cut-off frequency of 1/3 of 50Hz, for example, the value of the capacitors required for 50Hz is multiplied by three. For a cut-off frequency of approximately 17Hz, 0.47 $\mu$ F capacitors should be used at Switch S1a and S1b, and a .047 $\mu$ F capacitor at switch S1c.

**LIGHT DIMMER:** Over the years many circuits have been published in magazines for control devices. All are basically related to the light dimmer, but, alas, none of the designers ever provide a circuit for the light dimmer. After some searching and redesigning I have come up with a circuit which dims an incandescent lamp from nothing to full on, which has been tested to 1000W. At current prices this dimmer costs around \$5, an immense saving on commercial dimmers available that can handle 1000W. (The author encloses his circuit, which involves a hand wound suppression coil.) (B. P., Lower Mitcham, SA).

● Our Varilight Mk 2, published in April 1973, can be used with lamps up to 300W as presented, but higher loads may be handled to a maximum of 1000W if the Triac is mounted on an adequate heatsink.

**RADIO CONTROL:** Congratulations on a very good magazine. I would like to see a radio control project suitable for model boats and compatible with commercial servos and electric motors. Also, is there any intention for an add-on circuit for the "Chaser" in August 1980 EA which would allow an audio signal to control the chaser's speed and direction, similar to some commercial units now available.

Finally, have you published a circuit for an electronic roulette wheel using LEDs. If so, when, and do you intend updating (or publishing) a circuit for a voice-operated switch, as I believe commercially bought units can be quite expensive. (P. S., Doonside, NSW).

● We are considering developing a radio control system, as yours is one of the many requests we have had for such a project. However at the moment it is impossible to say when the project will be published. We have not given thought to developing an add-on circuit for the Light Chaser such as you

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describe. Perhaps you might be interested in our Musicolour III design published in the September 1976 issue.

We published circuits for an electronic roulette wheel and a voice-operated switch in the February 1976 and December 1977 issues respectively.

**MICROPROCESSORS:** The emergence of low cost microcomputers has aroused my interest in their future applications in the field of education. Albeit an old one, my current status is that of a student teacher. The financial implications therefore do not allow me the luxury of purchasing any one of the number of units that are available. This leaves me to fall back onto my RAAF training in electronics, in order to construct something suitable for experiments.

General reading on the subject has led me to a friend's copy of "Getting into Microprocessors", EA 1977, and the following applies: Do you have back copies of this publication? Have you published details of using the SC/MP chip

in the modular configuration as mentioned on page 55? Do the component suppliers still stand, or has a kit been compiled by a distributor? Could you please comment on or suggest possible alternatives as a basis for building from scratch?

Your assistance with the above will be most appreciated, as I have very little time in which to discuss the above at store level. (D. G., Wyoming, NSW).

● We have not published details for a modular form SC/MP microcomputer. We do not know of any suppliers stocking kits for the SC/MP microcomputer, although the components should be available with some hunting amongst component suppliers.

The EA publication "Getting into Microprocessors" is now out of print and has been replaced by an updated version called "Microprocessors and Personal Computers" which is available for \$5. Although the Miniscamp Computer

(continued on p151)

## Notes & errata

**COLUMN 80** (November 1980): The first paragraph in the second column on page 114 should refer to the "top address" as FF rather than FE. Also the lower I/O port in Figure 2 should be FE rather than FF and the two B4 outputs should be marked "Q" and "Q-bar" with the "Q" output driving relay 1 via the gate and buffer. Note also that relay 1 drives the internal deck while relay 2 drives the external deck.

**TV PATTERN GENERATOR** (June 1980, 7/RO/62): The LM340T-5 regulator IC shown in the parts list should be

LM340T-12. The circuit diagram is correct.

**STOP CLOCK** (October 1980, File No 7/CI/31): Information recently to hand indicates that the decimal point connection on the SEL620 LED displays is pin 9.

**CAR BATTERY MONITOR** (October 1980, File No 3/AU/26): The metallised polyester capacitor in the parts list should be 0.1 $\mu$ F, not .01 $\mu$ F. Overvoltage protection for the 4136 IC can be provided by connecting a 24V/1W zener diode directly across the 12V supply, in conjunction with a series 10 $\Omega$ /1W resistor.



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## Information Centre etc

using the SC/MP chip was only published a few years ago, in the field of microprocessors, developments occur at a fast rate. Consequently, you may find many microcomputers suitable for your application from the variety now available either in evaluation kit or personal computer form.

Possibly one of the most cost effective computers operating in machine language is the Dream Computer published in complete form in "Microprocessors and Personal Computers". Alternatively evaluation kits available from the microprocessor manufacturers represent good value for money. Computers running in BASIC are also available, at a considerable extra cost, and are normally fully constructed. The Sinclair ZX-80 reviewed in this issue is currently the least expensive.

**MAGNAVOX 8-30:** I have at present two Magnavox 8-30 speakers (described in January 1971) and have recently bought an amplifier with an output of 25 watts per channel. Could you please advise if these speakers will take the full output of the amplifier or must I limit its output so as not to damage the speakers? (J. W., Townsville, Qld).

● The Magnavox 8-30 loudspeakers will handle the full output of your amplifier on normal program material.

**TBA820 IC:** I am trying to buy a TBA820 IC. Everybody I have tried thinks I am mad. But I found a write-up in May 1977 which mentioned the device. Could you tell me who the agent is please? (G. O., Claremont, Tas).

● The TBA820 is made by the Italian manufacturer SGS-ATES, as noted in the sixth article in the series "Op. Amps. Without Tears" by Brian Dance, published in our May 1977 issue. SGS-ATES is represented in Australia by Warburton Franki Pty Ltd who have branches in Tasmania at 25-29 Barrack St, Hobart and 93 Margaret St, Launceston.

## ◀ NB: change to volume numbers

**With the increasing popularity of magazine binders and folders, many readers have asked that we adjust our volume numbering so that issues may be filed on a yearly basis. For this reason, Volume 42 will contain nine issues only (April-December, 1980) and all future volumes will commence in January and finish in December of the same year. An index for Volume 42 appears opposite.**



## ELECTRONICS AUSTRALIA

### PRINTED CIRCUIT BOARDS AND FRONT PANELS

Some readers have indicated problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and advertisements in the magazine should be carefully checked in the first instance. Failing satisfaction from this source, the following is a list of firms to which we supply PC and front panel artwork. Some may sell direct, others may only be prepared to nominate sources from which their products can be obtained.

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Applied Technology Pty Ltd,  
1a Pattison Avenue,  
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Concord, NSW 2137.

RCS Radio Pty Ltd,  
651 Forest Road,  
Bexley, NSW 2207.

Radio Despatch Service,  
869 George Street,  
Sydney, NSW 2000.

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101 Burgundy Street,  
Heidelberg, Vic. 3084.

Rod Irving Electronics,  
425 High Street,  
Northcote, Vic. 3070.

#### S.A.

James Phototronics,  
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Fulham Gardens, 5024.

#### W.A.

Jemal products,  
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Welshpool, WA 6106.

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D & H Electronics,  
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Hobart, Tas. 7000.

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Wellington, NZ.

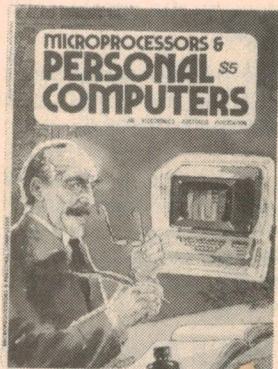
Marday Services,  
PO Box 19 189,  
Avondale,  
Auckland, NZ.

Mini Tech Manufacturing Co Ltd,  
PO Box 9194,  
Newmarket, NZ.

Printed Circuits Limited,  
PO Box 4248,  
Christchurch, NZ.

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### Just Off The Presses

## MICROPROCESSORS & PERSONAL COMPUTERS

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Microprocessors and personal computers, little more than a dream a few years ago, are now changing the face of electronics. This book introduces the basic concepts, describes a selection of microprocessor and personal computer systems, and details a build-it-yourself computer designed especially for beginners.

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# UNTIL WE DEVELOPED THE STEREO GROOVE, HI-FI WAS PRETTY HO-HUM!



The world of hi-fi owes a lot to the original and continuing innovation of JVC. Few companies, if any, have done as much to help turn records and record-players into the virtual musical instruments they are today ... or to lead the way in developing so many *firsts* in the more recent concepts of sound amplifiers, cassette decks and computer-designed speaker

systems. Hi-fi, as we know it today, had its beginnings in 1956, with JVC's development of the 45°/45° groove for stereo records. The fact that this system still remains as the world standard is, in itself, outstanding testimony to the technology of JVC. The development revolutionised not only the record-making industry, in which we've been involved since 1930; it also paved the way for enormous advancement in the design and engineering of record-playing equipment. Now, hi-fi has expanded to



R-S77. Super-A FM/AM Stereo receiver

embrace a wealth of highly-sophisticated electronic equipment; and it's not surprising that JVC has continued to play a leading role in so much of its development.



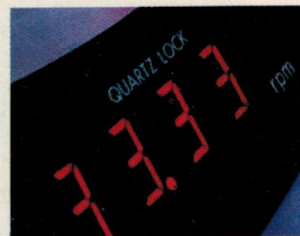
HR-3660 EA. VHS Colour Video Cassette recorder

## THAT WASN'T OUR ONLY FIRST, EITHER.

We also pioneered Japan's television industry, introducing their first TV receiver just over 40 years ago. A more recent innovation is VHS, the home video recording system now gaining world-wide acceptance as *the* system for such equipment. In the course of staying ahead, we've introduced a number of world *firsts* of radical importance: the Quartz Lock turntable is one of them.

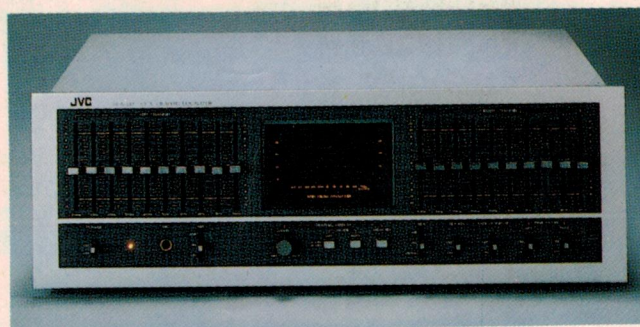
## THE QUARTZ LOCK TURNTABLE. MANY TIMES MORE ACCURATE.

It stands to reason that if your equipment is at the top end of the range, then your turntable must be capable of comparable performance. Only Quartz Lock ensures this, tying the speed of the turntable to the unvarying pulse of the atom, and providing a level of accuracy far in excess of conventional turntables.



## MORE MILESTONES IN HI-FI.

To match the superb quality of Quartz Lock, we produced the S.E.A. graphic equalizer system. Then we refined it to such a degree it even compensates for the effect your furniture has on sound when it leaves the speakers! To expand the capabilities of tape, we designed ANRS and



SEA-80. Stereo Graphic Equalizer

Super ANRS — automatic noise reduction systems which not only reduce distortion and 'hiss' but actually extend the dynamic range of the tape. Similarly, with speakers: at JVC we employ computers in their design to help provide the ultimate in sound reproduction.

## AND NOW, SUPER-A.

In its own way, as significant a hi-fi development as the stereo groove. Imagine an amplifier which combines the *best* features of the two recognised amplifier classes (A and B) ... an amp which combines the *efficiency* of one with the *low distortion* of the other. Some engineers said it couldn't be done; but not those at JVC. Enter the Super-A amplifier ... the *latest JVC first!*

Distributed and Serviced by ...  
**HAGEMEYER**



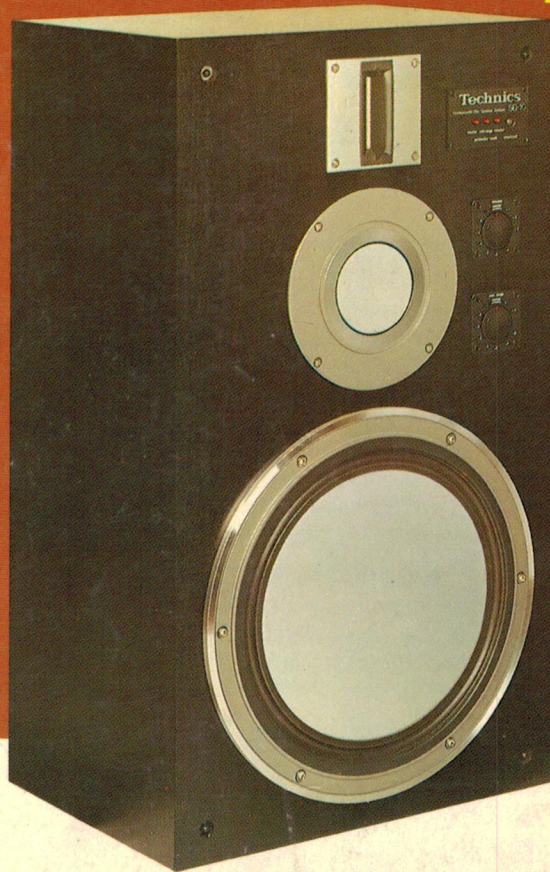
the right choice

## THE FUTURE.

It's already with us. For instance, we were so far ahead in the new metal tape technology that our cassette decks were metal-compatible before the tapes were generally available. And now there's the JVC Electro-Dynamic Servo Tonearm, damping tonearm resonance by means of a purely electronic system and two 'thinking' linear motors. Who was it who dubbed JVC, 'the innovators'?

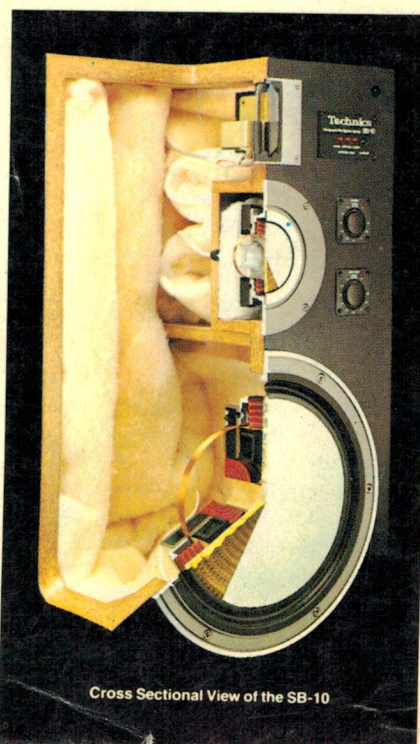


# The revolutionary Honeycomb Disc Speaker System!



Another Technics  
'first' that brings...

*Sounds  
Alive*



Cross Sectional View of the SB-10



The most obvious difference... between the new Technics honeycomb disc speaker system and conventional speaker systems is that the speaker units are flat instead of conical. This flat sound radiating surface at last puts an end to all of the distortions inherent in the traditional cone-shaped design. Cone shaped drivers suffer from something called the 'cavity effect' which causes peaks and dips in the upper end of the driver's frequency range.

But cone shaped drivers do have their advantages, namely a combination of low mass and high rigidity which contributes to pisonic motion. In designing this new Technics honeycomb speaker system we were faced with the problem of retaining or improving upon the cone-shaped speaker's low-mass, high-rigidity characteristics while developing a flat speaker surface. We found the answer in the 'axially symmetric honeycomb diaphragm.' It is well known that honeycomb structures are very light and strong, which is why they are extensively used in aircraft construction. In spite of the honeycomb's low mass, it is very rigid and difficult to bend.

## Technics